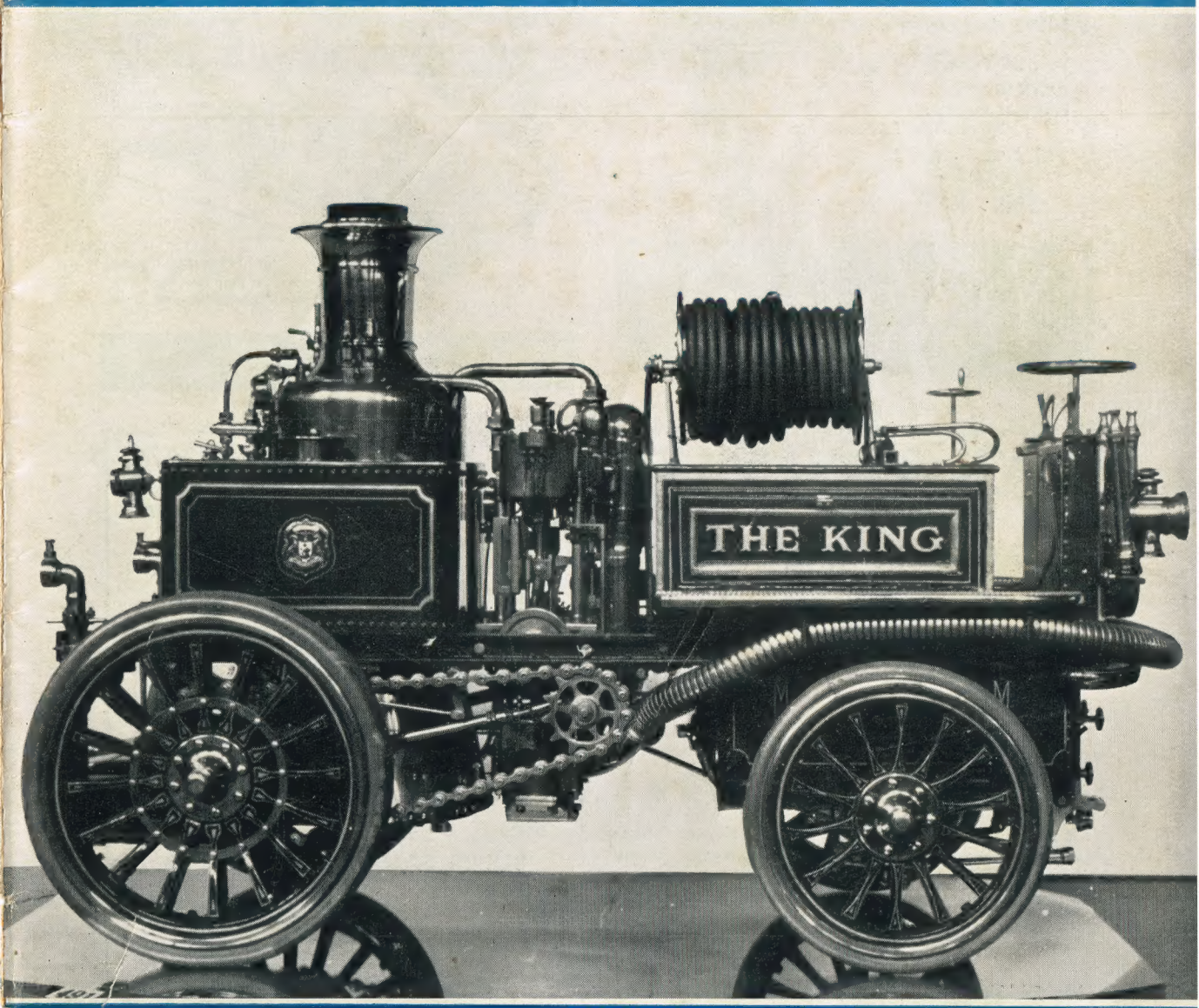
THE MODEL ENGINEER



IN THIS ISSUE

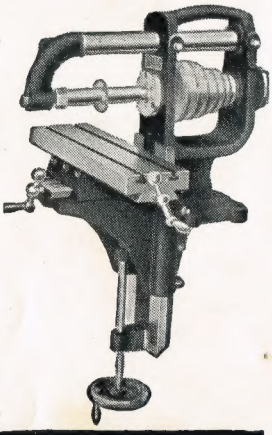
● L.B.S.C.'s "NETTA" ● BOILER DESIGN AND CONSTRUCTION
TWO NEW M.E. EXHIBITION TROPHIES ● READERS' LETTERS
● FINAL REVIEW OF THE NORTHERN MODELS EXHIBITION
FOCUS ON READERS' WORK ● MODEL POWER BOAT NEWS

MAY 13th 1954
Vol. 110 No. 2764

9D

Proved the world over

THE POOL BENCH MILLING MACHINE



AN ESSENTIAL FOR THE M.E.

★ **STURDY** 100-lb. weight

★ **WIDE CAPACITY** Table 14 in. x 3¾ in. Vertical Traverse 7½ in.

ACCURATE Precision Ground

★ Spindle and Table

VEE BELT DRIVE MACHINE

£32.5.0

Send for details

POOLS TOOL *Company Ltd*

Carlton Street, Nottingham

Phone : 44001 (3 *lines*)

Made Specially for You!

TRIANGLE BRAND

STOCKS & DIES

The Pack that slips into your pocket

Every handyman will welcome this New Pocket size set of Stocks and Dies in a carton. Threads available are Whitworth, B.S.F., B.A., Model Engineer's, B.S. brass, metric and American.

★ *"TRIANGLE" Brand Tools are obtainable from your usual Tool Specialists. In case of difficulty please write to :—*

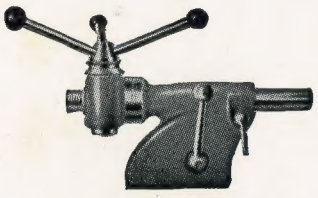
THE BRITISH TAP & DIE CO., LTD.

TRIANGLE WORKS, TOWN ROAD, EDMONTON, N.9

BUCK & RYAN LTD

FOR YOUR

MODEL ENGINEERS TOOLS



RACK FEED TAILSTOCK ATTACHMENT **for MYFORD ML7 LATHE**

£5 5 0

It is shown fitted to an ML7 tailstock, and the attachment includes a new tailstock barrel. It applies the same method of feed as on a drilling machine, sensitive and powerful. A graduated index collar is fitted. Also available for Drummond, Halifax, Southbend, Boxford Lathes, etc., at **£6.**

310, EUSTON ROAD, LONDON, N.W.1

Tel. : EUSton 4661

361, EDGWARE ROAD, LONDON, W.1

BOLD & BURROWS

TEL. 5951

12-18 VERULAM ROAD, ST. ALBANS, HERTS

ALL MODEL ENGINEERS SUPPLIES

Orders under £2 add 1/3 post. C.W.O. or C.O.D.

Send stamp for lists.

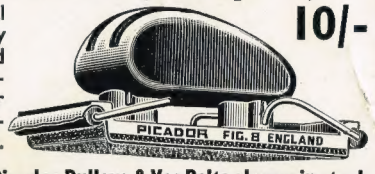
PICADOR DRILL GRINDING JIG

Simplifies accurate pointing of drills ⅛″ – ¾″.

42/-

SUPER SANDER (Area 4½″ x 3″)

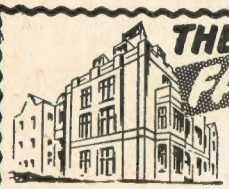
Most economical in use, practically designed and soundly constructed. Rubber faced base ensures resilience.



10/-

Complete range Picador Pulleys & Vee Belts always in stock

VISIT OUR SHOP AT THE ABOVE ADDRESS



THE FAMOUS

BENNETT COLLEGE can help you

to success through personal postal tuition

THOUSANDS OF MEN in important positions were once students of The Bennett College. They owe their success to Personal Postal Tuition —The Bennett College way. *You* have the same chance to qualify for a fine career, higher pay and social standing.

TO THE BENNETT COLLEGE, (Dept. M.17)
SHEFFIELD

Please send me free your prospectus on :

SUBJECT .....

NAME.....

ADDRESS .....

.....AGE (*if under 21*).....

PLEASE WRITE IN BLOCK LETTERS

One of these courses will lead to your advancement

Agriculture
Architecture
Aircraft Maintenance
Building
Carpentry
Chemistry
Commercial Art
Draughtsmanship
Electrical Engineering
Electric Wiring
Engineering Drawings
Fire Engineering
Forestry
Loco. Engineering
Machine Design
Mech. Engineering
Motor Engineering
Plumbing
Power Station Eng.
Quantity Surveying
Radio Engineering
Road Making
Sanitation
Steam Engineering
Surveying
Telecommunications
Textiles
Wireless Telegraphy
Workshop Practice
Accountancy Exams.
Auditing
Book-keeping
Commercial Arith.
Costing
English
General Education
Geography
Journalism
Languages
Mathematics
Modern Business Methods
Police Subjects
Salesmanship
Secretarial Exams.
Shorthand
Short Story Writing
and many others

GENERAL CERTIFICATE OF EDUCATION
R.S.A. EXAMS.

SEND TODAY *for a free prospectus on your subject.*
Just choose your course, fill in the coupon and post it.

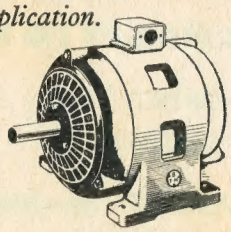
FOR GARAGE OR WORKSHOP

B T-H

ELECTRIC MOTORS

A.C. OR D.C.

BTH motors and associated control gear are second to none in quality and proved performance.
Types and sizes are available to suit any application.

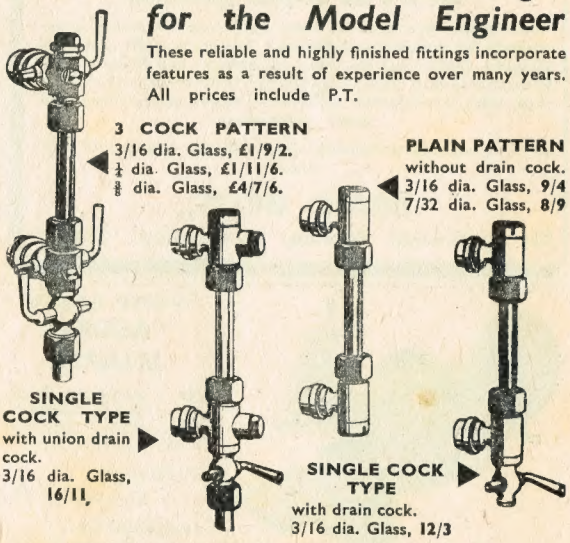


THE
BRITISH THOMSON-HOUSTON
COMPANY LIMITED, RUGBY, ENGLAND
Member of the AEI group of companies

A4565

BASSETT-LOWKE *Water Gauges for the Model Engineer*

These reliable and highly finished fittings incorporate features as a result of experience over many years. All prices include P.T.



3 COCK PATTERN
3/16 dia. Glass, £1/9/2.
¼ dia. Glass, £1/11/6.
⅜ dia. Glass, £4/7/6.

PLAIN PATTERN
without drain cock.
3/16 dia. Glass, 9/4
7/32 dia. Glass, 8/9

SINGLE COCK TYPE
with union drain cock.
3/16 dia. Glass, 16/11.

SINGLE COCK TYPE
with drain cock.
3/16 dia. Glass, 12/3

Write for "Model Shipping and Engineering Catalogue." A Manual every model engineer will want to possess, give the ref. MS/16. Price 2/-

BASSETT-LOWKE LTD

Head Office and Works :
NORTHAMPTON
London: 112 High Holborn, W.C.1. Manchester: 28 Corporation St.

WE ARE STOCKISTS OF

Myford, Zyto, E.W., Wakefield, Flexispeed, Super Adept lathes, Fobco Star and Champion drills, Perfecto and Adept shapers, Pools millers, Picador products, M & W., Eclipse, etc., tools, Burnerd chucks, Spiral saws All aircraft, ship and railway parts, kits, materials, etc. Distributors for Starlon and Celspray and all CALEY specialities (see previous ads.)

S.A.E. all enquiries

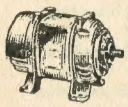
CALEDONIA MODEL CO.
5 PITT STREET GLASGOW C2
Corner of 468 Argyle Street

WATSON'S Special Bargain Offers

AIRCRAFT LAMPS

7 in. diameter easily converted to car spot-lights matt black finish. Price 8/6, post 1/6.

DYNAMOS



14/32 V, 9 A, 288 W. Shunt wound, ball bearing, foot mounted. Price **67/6.** Carr. 3/6.

ROYAL ENFIELD Twin cylinder air cooled industrial engines developing up to 5 h.p. at 3,000 r.p.m. Each in steel frame complete with petrol tank etc., ready for use. **£16 10s. 0d.** Carr. 17/6.

Hundreds of other bargains available. Electrical, mechanical material, etc., England's finest value. Send stamp for list.

EASTERN MOTORS · ALDEBURGH · SUFFOLK Phone 51

REFRIGERATION FOR THE HOME CONSTRUCTOR

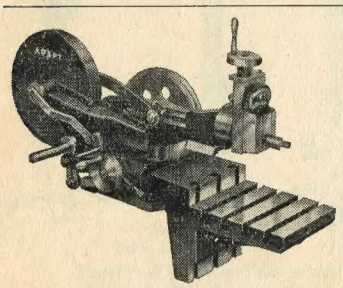
We are the original specialists

Our components are of the finest quality and are designed exclusively for domestic installations. We do not sell unsuitable scrapped deep freeze ice cream components, and do not wish to be associated with these parts. Our aim is to enable you to build a really efficient refrigerator which will give you correct results and every satisfaction.

Send stamped addressed envelope for our 16-page free list and hints booklet

BRAID BROS.,

50, Birchwood Avenue, Hackbridge, Surrey



WORLD FAMOUS "ADEPT" SHAPER

No. 2 model now fitted power-drive attachment, 6¼ in. stroke. 3 speeds of automatic cross feed.

As illustrated price **£29 12s. 6d.**

Attachment only price **£10 15s. 0d.**

Extra for fitting to your machine at our works, **£1 12s. 6d.** (Carr. extra)

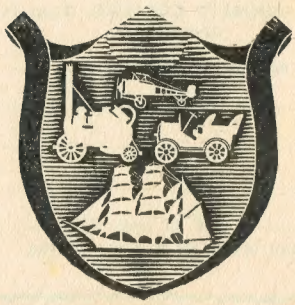
ASK YOUR DEALER, or write for particulars to:—

F. W. PORTASS MACHINE TOOLS LTD.
Adept Works, 55, Meadow Street, Sheffield, 3

An Invitation to

MODEL ENGINEERS

Exhibit your model at the world's finest display of models



Entry forms and details of the various competition classes at "The Model Engineer" Exhibition are now available on request from The Exhibition Manager, 19-20, Noel St., London, W.1

1954

The Model Engineer

EXHIBITION

NEW HORTICULTURAL HALL, WESTMINSTER

AUGUST 18—28th

2,000 H.S. Side and Face Cutters, 1" hole 2½" dia., ¼" thick, 15/-; ⅜" thick 17/6; ½" thick 20/-. 3" dia., ¼" thick 17/6; ⅝" thick 20/-; ¾" thick 22/6; ½" thick 25/-; ⅝" thick 27/6. 3½" dia., ¼" thick 20/-; ⅝" thick 22/6; ⅜" thick 25/-. 5" dia., ⅜" thick 55/-; 1" thick 65/-.

5,000 H.S. Morse Taper Shank End Mills, spiral teeth. No. 1 shank ¼" dia. 6/6, ⅜" dia 7/6, ⅝" dia 7/6, ½" dia 8/6. No. 2 shank ⅜" dia. 10/6, ⅝" dia. 12/6, ¾" dia 12/6, ⅞" dia. 14/-, 1" dia. 15/-. No. 3 shank 1¼" dia 22/6. No. 4 shank 1⅜" dia 25/-, 1½" 27/6, 1¾" 35/-, 1⅞" 40/-. No. 5 shank 2" dia. 50/- each.

3,000 Circular Split Dies 1" dia. cutting ¼", ⅜", ⅜", ⅞", ½" Whit., B.S.F., also brass thread, 26 thread all sizes and American N.F. 12/- per set of 5 sizes, 2 sets 22/6, 4 sets 42/6. Taps to suit 9/3 per set, either taper or second or plug. 1" die-stocks 5/- each; ⅜" to ½" tap wrenches 12/6 each.

2,000 H.S. Long Twist Drills all straight shank ⅛" to ⅜" dia. 4" to 6" long, 5 assorted, 10/-. Would cost much more than treble this price.

500 H.S. No. 1 M.T.S. Twist Drills, ¼" to ½" dia., 3 ass. 10/6, our selection; 6 for £1.

1,000 Hand Reamers, ¼", ⅜" and ⅜", 8/6 per set of three; 3/6 each.

1,000 High Speed Inserted Blades Expanding Reamers, 17/32" to 19/32" 14/-, ⅝" to ⅞" 16/-, ⅞" to 1" 17/6, 1" to 27/32" 17/6, ⅞" to 31/32" 18/6, 31/32" to 1⅛" 22/6 each.

2,000 Small High Speed Twist Drills, approx. 1/32" to 3/32" dia., doz. assorted 4/-.

100 H.S. Concave Cutters, dia. of circle ⅜" or ⅝", cutter dia. 2½", hole 1", 12/6 each.

1,000 High Speed Parting Off Tool Blades, Eclipse brand: ¼" × 3/32" × 4½" long, 4/- each; ⅜" × 3/32" × 5" long, 5/- each; ⅜" × ⅜" × 6" long, 5/- each; ⅜" × 3/32" × 6" long, 6/- each.

7,000 Pratt & Whitney, circular split dies, superior quality precision ground cutting edges, ⅜" dia., suitable for machine or hand use. Sizes: 2, 4, 5, 6 B.A., 8/6 per set.

1,000 Extra Long Twist Drills, straight shank, H.S. or carbon, ⅛" to ⅜" dia., 6" to 8" long, six assorted 15/-.

5,000 Ball Races, ¼" bore, ⅜" o.d., ⅛" thick, 4/- pair; ¼" bore, ⅝" o.d., 7/32" thick, 4/- pair; 6 mm. bore, 19 mm. o.d., 6 mm. thick, 4/- pair. 12 mm. bore, approximately ½", 35 mm. o.d., 9 mm. thick, 4/- pair; 9 mm. bore, 26 mm. o.d., 8 mm. thick, 4/- pair; ⅜" bore, ½" o.d., 7/32" thick, 5/- pair.

4/9 Any LOT. Five lots 22/6. 2 H.S. Tap or Reamer Fluting Cutters 1½" dia., ⅝" hole, ⅛" and ¼" thick, worth 7/6 each. Set 5/32", ⅜", 7/32", ½", all in 40 thread, ⅛" Split Dies: 8 assorted Centre Nail Pin and Belt Punches, total value 12/6; one H.S. Tap or Reamer Fluting Cutter, 2½" dia., ⅜" thick, ½" hole; one ⅜" H.S. Hand Reamer, worth 10/-. Every item a good bargain.

5,000 Twist Drills. Standard Jobbers, carbon and high speed mixed, best British and American make, sizes ⅛" to ⅜" in fractional number and letter sizes, a really splendid selection, 1 dozen assorted 10/-. Please note we cannot supply to stated sizes at this price, only our selection, actual value more than treble.

500 Sets Metal Figure Punches, nine punches 0 to 8, the six is used reverse for nine; size 5/64" 6/6 set, worth 15/-; ditto 1/8" size, 8/6.

3,000 High Speed Tool Bits, ⅜" square, 3" long, hardened ready for use, 12/6 doz., 3 doz. 35/-. Ditto ⅜" round, 3" long, 8/6 per doz.

2,000 Files, 4" to 6" flats, half-rounds, rounds, squares, warding assorted, cuts, good general lot, 10/6 doz.; three doz. 28/6.

600 Circular Split Dies, B.T.D. make ¼" dia., ⅝", ¾", ⅞", 1" Whit. ⅜" Gas; worth 11/- each. Clear 7/6 each, new 2½" die-stock to suit, worth 30/- each, clear, 10/- each.

200 Boxes A to Z Steel Letter Stamps for marking metal, 5/64" size, 17/6 set; ditto ⅛" size, 22/6 set, worth treble this price.

2,000 Straight Shank End Mills, size ⅛", 5/32", ⅜", 7/32", ¼", ⅜", list price 30/- set, handy bargains, 15/- set also ⅝", ⅜", ½" ditto 12/6 set, all in makers' wrappings.

500 H.S. 90° Countersinks, body ¼" dia., teeth cut to point. An essential tool for any workshop using c/s screws. Gift 5/- each.

1,000 Bevelled Wood Chisels, handled, ¼", ⅜", ⅝", ½", ⅝", ¾", ⅞", 1". Actual value 32/6. Gift 21/- set.

2,000 Rotary Files, 3/32" shank, various shapes. Six for 6/6, 12, 12/-. Very handy.

3,000 High Speed Routing Cutters, straight shank, two lip, as used for cutting slots in wood, sizes ⅝", ½" dia., clear 4/- each.

1,000 Toolmakers' Needle Files, good assortment of shapes and cuts, worth 1/9 to 2/6 each, 12/6 doz.

200 Ace Dial Gauges. 2½" face, reads to 0.001", plus and minus, very useful instrument, worth 60/-, gift 45/-.

300 High Speed Straight Shank End Mills, ⅞" dia., 10/- each.

20,000 High Speed Milling Cutters. Counterbores and Countersinks, Radius and Angle Cutters, ⅜"-1½" dia., 10 assorted 25/-. Actual value 5/- to 15/- each.

10,000 High Speed End Mills Straight Shank 3/32" to ⅜" dia., some with teeth cutting both ends but not standard sizes, clear 5 assorted, 10/-.

200 Cast Steel Circular Saws for Wood, 4" dia., 6/- each; 6", 10/-; 8", 13/6; 10", 18/-; 12", 24/-. Larger sizes. Prices on application.

50,000 Brass B.A. Screws, 2, 4, 6, 8 B.A. Various type heads most useful stock. 2 gross ass. 4/9.

100 doz. 6" Three square Saw Files, 10/6 per dozen.

1,000 Carborundum Grinding Wheels, fine and medium coarse, useful pair for tool grinding 6½" dia., ½" thick, 1" hole, 7/9 per pair. Easily bushed to suit your spindle. Actually worth more than double. Also 5" dia. cup wheels ½" hole medium coarse, 4/9 each. Also 6½" dia. ½" thick, ¾" hole, 4/9 each.

1,000 H.S. Taper Pin Reamers, 7/32" size, 5/- each, also Nos. 5, 6, 7, 8, 9, 10, 5/- each. 30/- set of 7.

500 H.S. Angle Cutters as used for milling teeth in slitting saws and milling cutters. Actual value £3 each. 2½" dia., 1" hole. Clear 25/- each.

400 H.S. Milling Cutters and Angle Cutters, 1½"-2" dia., ⅝" hole, 4 ass. 22/6. Useful bargain.

100 H.S. Slotting Cutters, 5" dia., ⅜" thick, 1" hole, 12/6 each.

200 H.S. Slitting Saws, 8" dia., 3/32" thick, 1" hole, 20s. each. Also 5" dia., 1/32" to 3/32" thick, ⅛", ⅜" and ¾" holes, 6s. each. 3 for 15s.

500 Tee Slot Cutters, cutter dia. ⅝", width ⅜", neck ¼", shank ½", 10/- each.

1,000 "Leytool" Ratchet Spanners, ⅛", ¼", ⅜", ⅜", ⅞", ½" Whit. Makers' price 70/- per set. Very useful bargain, 35/- per set.

100 H.S. No. 1 M.T. Shank Reamers, ⅞" dia., 7/6 each.

250 H.S. Twist Drills. No. 1 & 2 M.T.S., slightly used but reground, as good as new. These are very cheap at present day twist drill prices. Sizes 27/64", 4/-; 29/64", 4/6; 15/32", 4/6; ⅜", 6/-; 19/32", 6/6; 39/64", 7/-; 45/64", 8/-; ⅞", 10/-; 29/32", 12/-; 55/64", 12/-; Also new straight shank drills, 27/32", 6/-; 1⅛", 10/-; Letters M, 2/-; X, 2/6 each. All high speed.

1,000 Semi High Speed Centre Drills, Slocombe brand, ⅛" body diam., 3/32" points, 1/6 each, 16/6 per doz.

5 Tons High Grade Tool Steel, ⅛" & ⅛" diam., bright or smooth blue finish, but slightly soiled, actually cost 1/3 per lb., handy stuff for any workshop, 14 lb. any size or both, 8/6, plus 2/- postage.

All items brand new. £1 orders post paid. Prompt delivery. Inspection by appointment only. All items sent on approval against cheque or P.O. Refund without question if any item returned.

J. BURKE, 192 Baslow Road, Totley, Sheffield

Inspection Only at Rear 36, Fitzwilliam St., Sheffield.

For those who *INSIST on the BEST!*

"NETTA" . . . *Designed by* "L.B.S.C."

	2½" G.	3½" G.	5" G.	
Frame steel	3/-	7/-	18/6d.	
Buffer beam angle	1/7d.	1/11d.	4/-	Set
Main horns, hot pressed stampings	12/-	12/-	—	Set
Main horns, castings	—	—	27/-	Set
Main axleboxes	5/8d.	11/-	—	
Main axleboxes, solid	—	—	35/-	Set
Main axleboxes, split	—	—	46/9d.	Set
Drivers, 14 spokes, correct balance weights	12/-	20/-	—	Set
Drivers in soft grey iron	—	—	36/-	Set
Frame stay	1/4d.	2/3d.	4/6d.	
Pump stay	1/9d.	2/9d.	4/6d.	

Drivers for gauge 1, 1/- each. Postage extra.

A 1/- stamp or P.O. will bring you a copy of our comprehensive illustrated catalogue NEW 1954 EDITION, with details of blueprints, castings and materials for many "L.B.S.C." designed small steam locomotives; workshop equipment, etc.

All orders despatched insured against loss or damage in transit. OVERSEAS ORDERS correct documentation assured.

A. J. REEVES & CO.

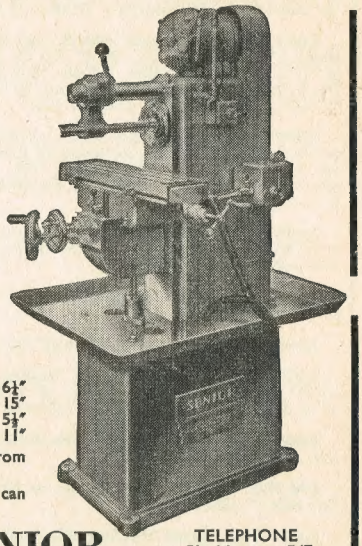
416, MOSELEY ROAD, BIRMINGHAM, 12

Grams: "Reevesco, Birmingham." Phone: CALthorpe 2554

"The choice of experience"

BRITISH BUILT MILLER *of the Highest Class*

This is a Precision Miller, built to fine limits. In addition to the high grade craftsmanship special care is taken in the painting work. All castings are carefully filled, and rubbed down before the final oil resisting paint is applied. Hand wheels, levers, etc., are bright chromium plated, resulting in a superbly finished machine. Micrometer Collars have matt finish with black waxed markings for easy non-dazzle reading.



MODEL M.1

Table . .	25" x 6½"
Table travel . .	15"
Cross feed .	5½"
Vertical feed . .	11"

12 Spindle speeds . . . from 50 to 1,660 r.p.m.

Full range of accessories can be offered

TOM SENIOR

LIVERSEDGE, YORKS., ENGLAND

TELEPHONE Cleckheaton 547

TELEGRAMS: Senior, Cleckheaton 547

If further interested write for Brochure fully describing the machine with its range of attachments

An outstanding tool of patented design with many unique features. In particular, the operating nut, being clear of the end, is unlikely to be loosened inadvertently; and the gripping of the tap by the *whole* depth of the jaw ensures absolute rigidity.

Made by James Neill & Co. (Sheffield) Ltd. and obtainable from your usual suppliers

S.T.W.1

Fine Value for Money!

WIRELESS REMOTE CONTROL UNITS. Ex-W.D. stock in new condition a strong teak box 12 in. x 8½ in. x 6½ in. with drop front and lid; full of useful components, wired in metal chassis. **One** Hand Magneto Generator. **One** circular bell with mechanism under gong. **Two** dewar key switches. **One** press key switch. **One** paper condenser. **One** Electrolytic Condenser. **One** W/T Morse Key precision well balanced type on bakelite base with large finger plate and insulated knob. **One** Mike Transformer. **One** panel warning light with red glass, three plated terminals. **One** resistance coil **One** 5-way plug socket. **All for 25/-**, plus 3/6 carr.

PERISCOPES. Beautifully made precision instruments, ex-W.D. in ali. case 3½ in. x 4½ in. x 1½ in. each fitted angle prism. Easily extended to height required by metal or wood strips. Price **6/3 per pair** plus 1/9 post.

PENDULUM INDICATORS for battery operation; surface type in polished hardwood dustproof case. Bobbins wound enamelled copper wire, with dropping indicator flags, 2-3-4-5-6-8-10 way, all as new and offered at 50 per cent. off makers list price. **Write for list.**

KNIFE SWITCHES. 30 amp. open type mounted on enamelled slate panel, quick break D.P.C.O. **15/-** each, post 2/-.

FLOAT SWITCHES. 5 amp. Mercury Switch in C.I. Box operated by ball float for controlling motors up to 250 volts, **45/-**, plus 2/6 post and packing charges. Complete with float and rod. Larger sizes quoted for.

MAGNETS. D.C. 5 volt electro Magnets twin coil weight 10 oz. lift 4 lb., **5/-**, post 1/-. Circular Instrument Horseshoe Magnets, S.L.S.36 diameter 1¾ in. with ½ in. polar gap, drilled poles **2/6**, post 6d. Alni Disc Magnets, ⅝ in. diameter, ⅜ in. thick with 3/16 in. centre hole **3/6**, post 6d.

TRANSFORMERS. 230 volt, 50 cyl. input 12 volt. 8 amp. output, **30/-**, post 2/6. 230 volt. input, 53 volt. 15 amp. output **£6 10s. 0d.**, carr. 5/-. Write for list. We design and build Transformers for all purposes.

NIFE BATTERIES. 12 volt, 45 a.h. steel cells ten 1.2 volt cells in wood crate **£12 10s. 0d.**, carr. 10/-; single cells **30/-** each, post 2/-. 6 volt 68 amp. five cells in wood crate **£9 10s. 0d.**, carr. 10/-. 2.4 volt 125 a.h. in wood crate **£5**, carr. 7/6.

ELECTRADIX RADIOS

Dept. D. 214, Queenstown Road, Battersea, London, S.W.8

Telephone: MACaulay 2159

THE MODEL ENGINEER

EVERY THURSDAY

Volume 110 - No. 2764

MAY 13th - 1954

ESTABLISHED 1898

PERCIVAL MARSHALL & CO. LTD. 19-20 NOEL STREET, · LONDON · W. I

CONTENTS

SMOKE RINGS	513
TALKING ABOUT STEAM A model Merryweather Fire Engine	514
MORE UTILITY STEAM ENGINES Boiler Design and Construction	518
FINAL REVIEW OF THE NORTHERN MODELS EXHIBITION	522
TWO NEW "M.E." EXHIBITION TROPHIES	525
FOCUS ON READERS' WORK	526
IN THE WORKSHOP Constructing an Engraving Machine	528
L.B.S.C.'s "NETTA" A North-eastern T-class "Mitey" Hauler in five gauges	531
CRAMPTON RETROSPECT	535
READERS' LETTERS	536
MODEL POWER BOAT NEWS More American Boats	538
STAYING A BOILER	540
WITH THE CLUBS	541

Our Cover Picture

This week's photograph shows an exceedingly fine model of a Merryweather self-propelled steam-driven fire engine. The model was built to 2-in. scale many years ago by Mr. Jonas Francis of Cardiff, who was engineer fireman to the Cardiff Fire Brigade at that time, and had the prototype under his care.

Complete in every detail, the model works perfectly. The boiler is of the oil-fired water-tube type, and will raise steam in thirty-five seconds: jets of water can be thrown forty feet. Even the chemical extinguishing equipment is incorporated, and this also works.

For some time now the model has been on indefinite loan to the Science Museum at South Kensington, but it was exhibited, through their courtesy, at the Cardiff S.M.E. Exhibition last winter. For further details of this magnificent model, see the article on "Talking About Steam . . ." starting on the next page in this issue.

SMOKE RINGS

The Duke of Edinburgh Trophy

IN CONNECTION with the judging of the entries for the above Trophy at the forthcoming Model Engineer Exhibition, we are pleased to announce that Professor A. M. Low has kindly consented to act as chairman of the Judging Panel.

His qualifications in the engineering field are well-known to most of our readers, as he has been a pioneer of many inventions which have had far-reaching effects in the modern world, and he is frequently consulted on industrial and technical development and research in many widely varying fields. It is, therefore, clear that he will be able to bring an entirely impartial outlook to bear on the important task he is undertaking on this occasion.

The "Juniors" New Headquarters

THE SALE of an interesting London property is reported; Hillier, Parker, May & Rowden, of 77, Gosvenor Street, W.1, have sold Pepys House, 14, Rochester Row, Westminster, S.W.1, to the Junior Institution of Engineers, who will make it their head-quarters in place of their office at 39, Victoria Street, where they have been since 1901.

The Junior Institution of Engineers, which began in 1884 as an association of apprentices in the famous engineering works of Maudslay, Sons & Field Limited, in Lambeth, is in point of years the tenth oldest engineering institution in London and now has a membership comprising representatives of practically every branch of Engineering, extending all over the world. The present President is Sir John Hacking, M.I.E.E.

Pepys House, which was the Parish Office of the parish of St. Stephen with St. John, Westminster, has a distinctive elevation of red brick, with stone facings, characteristic of the late 19th century, when it was built. It takes its name from Lady Emily Pepys, who was an assiduous worker among the poor of the parish from about 1869 to the early nineties, and was formally opened in 1896 by the Most Rev. Dr. Frederick Temple, the then Archbishop of Canterbury.

Lady Emily was a daughter of Sir Charles Christopher Pepys, Bart., Lord Chancellor of England from 1836 to 1841 and again from 1846 to 1850, who was raised to the Peerage as Earl of Cottenham on his retirement from that office. The family (who pronounce their name "Peppis") are related to Samuel the diarist, both being descendants of the 16th Century Pepys of Cottenham, in Cambridgeshire.

Steam Launches in 1954

IT IS of more than usual interest to learn that two steam launches are being built at Wootten's boathouse at Cookham, Berks; they should be ready for service during the coming summer. One of them is really an old one that is being thoroughly re-conditioned and is having a new boiler fitted; she is named *Pierette*, and, when finished, will look very much as she did when originally built in 1892 by George Desvignes of Teddington. The other launch is called *Firebrand* and is a smaller craft. Both will belong to Mr. J. B. Hickey of Cheshunt.

It is more than thirty years since any steam launches were built on the Thames; therefore, the two that we have mentioned are sure to be eagerly looked for by many MODEL ENGINEER readers.

West Riding S.L.S. Secretary

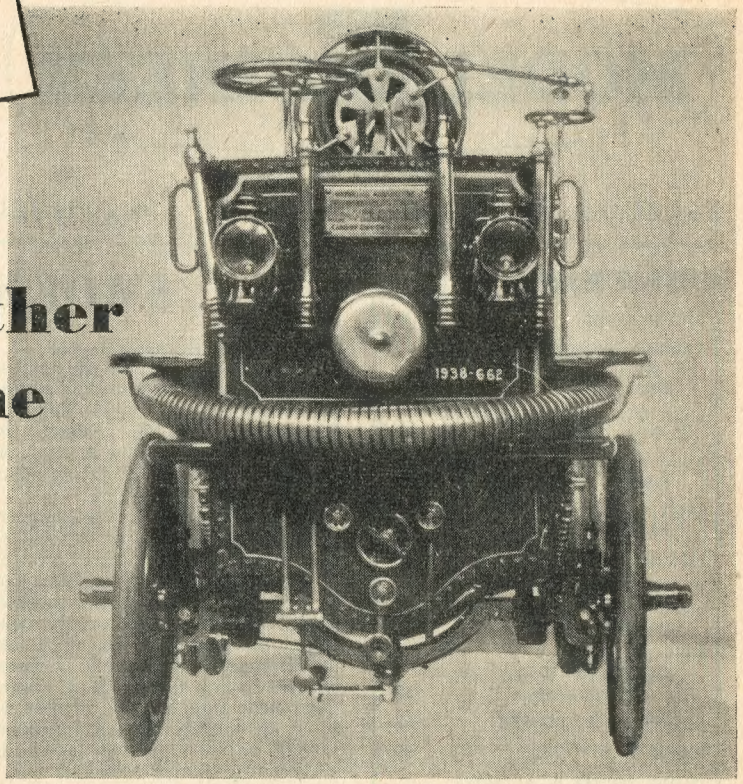
THE WEST RIDING Small Locomotive Society now has a new hon. secretary, Mr. F. W. Spencer, 179, Raikes Lane, Birstall, near Leeds, who succeeds our old friend Dan Hollings. A copy of the March issue of the society's "Bulletin" that has come to hand shows that Mr. Spencer evidently intends to carry on the good work in the manner so ably perfected by his predecessor.

Talking about Steam

No. 26

By W. J. Hughes

A model Merryweather Fire Engine



This beautiful 2-in. scale model of a self-propelled steam fire engine was built more than 40 years ago by Mr. Jonas Francis of Cardiff. Front view shows the electric gong, chemical tank controls, and steering

I HAD intended to devote this week's article, as last time, to consideration of some more " bits and pieces " of prototype stationary engines, but, owing to illness, there has been no time to make any drawings, unfortunately.

However, fate has been kind in another direction, because I have received from Trevor Whitaker, of Cardiff, some photographs and notes of a superb model fire engine, and it is these which form the basis of this article. As I have mentioned in my Allchin—M.E. articles, he has been very helpful in that direction; and now we are indebted to him for the further trouble he has taken.

Many readers will already have seen this model, which was built nearly half-a-century ago by Mr. Jonas Francis of Cardiff, for it has been " on view " for much of that period. Soon after completion, it was loaned to the Cardiff City Council for some years, and was then presented by Mr. Francis to the National Museum of Wales.

In turn, the Welsh museum loaned the model in 1938 to the Science Museum at South Kensington, and then last December it again made an appearance in its city of origin, at the Cardiff Exhibition. Incidentally this was the first time Mr. Francis had seen his engine for twenty years !

The model is built to 2-in. scale, and the prototype was a Merryweather fire engine worked by the Cardiff Fire Brigade from 1905 to 1915. Even after that it was in service as a pumping engine until 1938-39.

Mr. Francis was a member of the Fire Brigade, as an engineer fireman, and often drove the prototype during the course of duty, also carrying out repairs and maintenance. The model was commenced in 1906, and during the building Mr. Francis was loaned drawings by Messrs. Merryweather.

It was not completed until 1912, but was exhibited, not quite finished, at the Bath and West Show at Cardiff in 1911. Here Mr. James Merryweather made a point of inspecting the model, and then had it transferred to the firm's stand. It is understood that he considered it to be worth at least half the cost of the prototype !

Completely Working Model

The engine is of course a completely working model, and under steam runs at a speed of four to six miles per hour. When pumping it will throw one 5/32-in. jet or two 3/32-in. jets a distance of forty feet; quite a useful performance for a model ! The weight is about 40 lb., the length 2 ft. 2 in., breadth 1 ft., and height to top of chimney 1 ft. 6 in.

The chassis members and the axles were cast in brass in Mr. Francis's own workshop, from his own patterns. Many of the other parts were fabricated by silver-soldering, being first dowelled with 1/32-in. diameter pins, or, if made from sheet, being dovetailed together before silver-soldering.

All the wood that was used was mahogany from an old warship broken up at Penarth in 1902. The wooden parts include the road wheels, foot boards, hose box, driver's seat, and tool-box.

In building the wheels, which are 7-in. and 5-in. diameter respectively, tenons on the spokes fit into mortises in hubs and felloes, in the normal way. Rubber tyres are fitted to the rims, and the hubs are reinforced with metal caps which are bolted through. The rear wheels are further reinforced by metal rings in way of the driving sprockets and brake drums.

Internal expanding brakes work in the latter, operated by turning the handwheel on the driving platform, and the hand-brake lever operates a contracting band at the differential. The springs are fully detailed with working leaves and beautiful U-bolts and shackles.

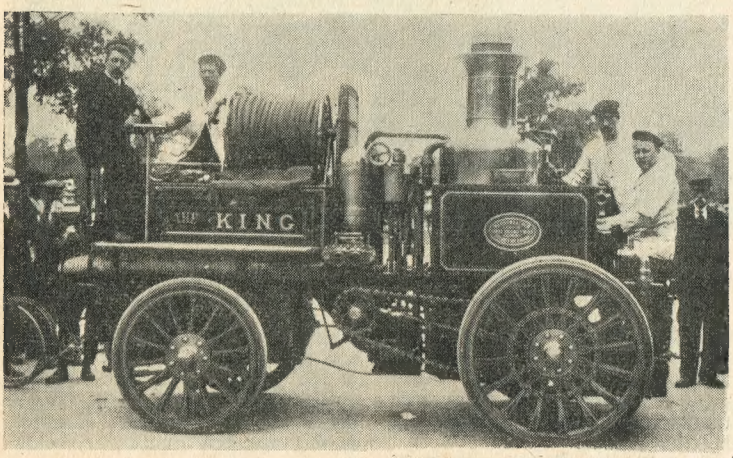
The boiler is made of copper; it is of the water-tube type, and, believe it or not, contains *two hundred and thirteen* copper tubes. These are 5/32 in. o.d. and 3/32 in. i.d., and are expanded into the holes in the firebox, which is 3¾ in. diameter and 3⅞ in. to crown. The rest of the boiler is silver-soldered and works at a pressure of 150 p.s.i.

Brass cleading is fitted to the boiler, and was made by dovetailing and silver-soldering a tube up out of brass sheet. This was then spun to shape at the top on a wooden former in the lathe. The beading was done by hand on a tinman's "jinney".

As in the prototype, the boiler is oil-fired, and can reach working pressure in *thirty-five seconds* from an initial pressure of 5 p.s.i. In the original, by the way, this intitial pressure was kept constantly on the clock, by having a gas ring burning in the fire-box as she stood in the station.

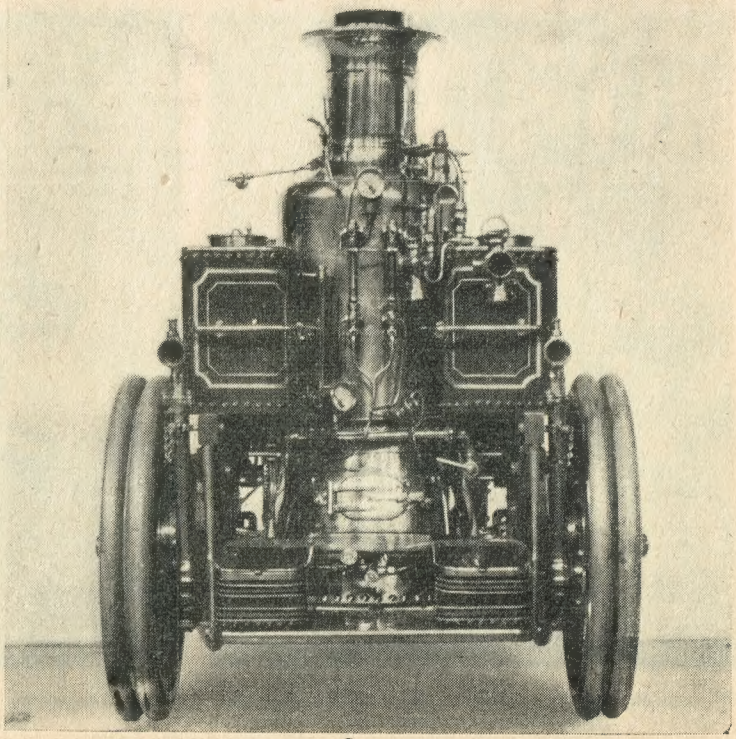
When the alarm was given, in went some oily waste and out came the gas-ring; steam and oil were turned on to the atomising burner, and the full pressure of 200 lb. was raised in seven minutes, although of course the vehicle could move off considerably before, at a lower working pressure. When running the model, Mr. Francis used to raise 5 lb. with a miniature blow-lamp, and then turn on the atomising burner.

It will be noticed, however, that there is a normal fire-hole and door, and that fire-bars are fitted. This is so that if prolonged use appeared likely to exhaust the oil-fuel tank coal could be used to carry on. The coal is carried in two small bunkers each side of the boiler footplate, (seen in the rear view) and the oil in two tanks at each side of the chemical extinguisher tank. These three tanks are slung over the front axle, which by the way is fitted with full Ackermann steering. Oil feed is by gravity to the burner.



The prototype owned and run by the Cardiff Fire Brigade from 1905 *to* 1916

Right :
Rear elevation of model: water tanks above, suction stand-pipes at sides, and coal bunkers on foot-plate



Two spring safety-valves and two water-gauges are fitted, and there is also a fusible plug. The water supply is carried in two tanks flanking the boiler, which is fed either by injector, or by a mechanical pump driven from the crankshaft.

The engine is of the double-cylindered simple type, with a bore of 1 in. and stroke of 1½ in., the pistons being fitted with brass piston-rings. The crankshaft is built-up, pegged, and silver-soldered, and a dog-clutch is fitted to enable the road-wheels to be driven. When it is disengaged, of course, the engine pumps only.

There are dual pumps, vertically below the crankshaft, and these are driven directly from the piston-rod crossheads by means of parallel rods. The latter pass each side of the crankshaft, and are fixed to crossheads attached to the pump-rods. The pump-barrels are ⅞ in. in diameter, and naturally the stroke is 1⅛ in. A large air-vessel is fitted, and this is lagged by brass, silver-soldered and spun to shape like the boiler-lagging.

Stephenson link-motion is fitted to the engine, with three positions

for the reversing-lever each side of the centre.

Differential gear is fitted to the countershaft from which the road-wheels are driven, and the bevel-wheels were *cut and filed by hand*, as were all the chain-sprockets. Think of that, you spoon-fed wallahs ! How many hours of labour went into *that* little job ?

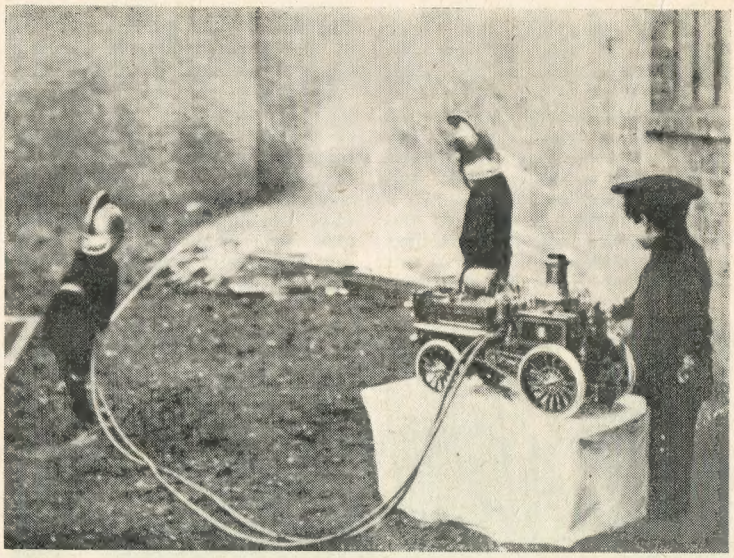
Chemical Extinguisher

As mentioned previously, the chemical tank is situated over the front axle between the fuel tanks. It is 4½ in. long and 3 in. in diameter, containing a lead bottle of sulphuric acid, surrounded by soda. When the large central handwheel on the front of the tank is rotated, a striker pierces the lead bottle, releasing the acid and thus starting the reaction.

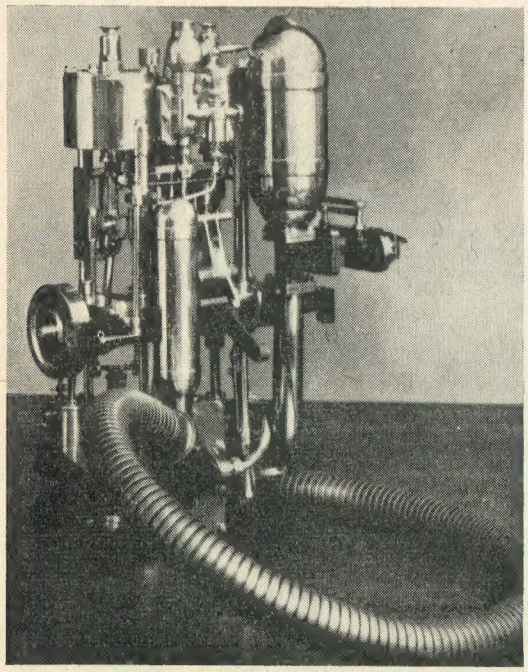
The pressure created is 100 p.s.i. in thirty seconds, and the discharge is through the wheel-valve immediately to left of the hand-wheel to the hose, which is carried on the reel behind the driver's seat. It has a jet $\frac{1}{16}$ in. in diameter, through which the chemical discharge will last for three minutes. The valve to right of the hand-wheel is for the overflow, and the one below, with the union underneath, allows the tank to be flushed out after use.

A further point is that through it the tank can be connected by hose to a hydrant; the water will then rise through the tank and be forced out through the " chemical " hose, giving a small jet to deal with smouldering debris without running the main pumps.

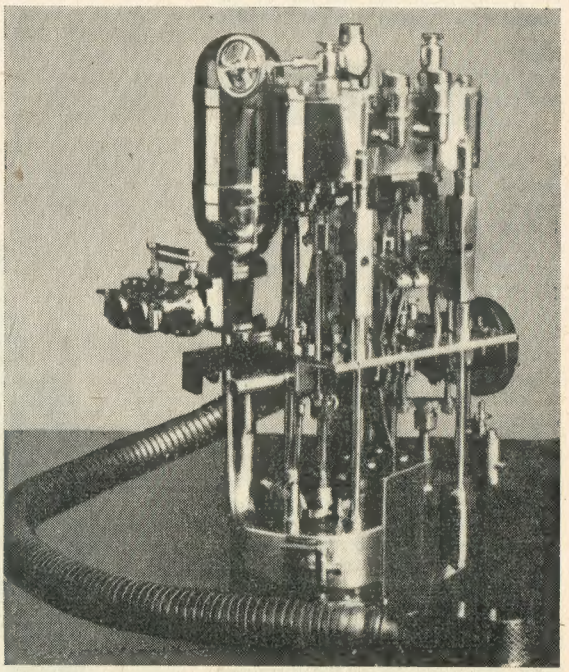
At each side of the boiler foot-plate will be seen a stand-pipe; these are connected to the suction side of the pumps. The two delivery outlets may be seen in the photo-graph of the prototype, mounted on the valve-box immediately below the air-vessel



Dressed appropriately, the builder's children (who now have families of their own !) demonstrate that the machine really works !



Flywheel side of the engine, showing suction hose for taking water from ponds, etc.



Rear three-quarter view: note rods driving pump crosshead at the right of photograph

To these, of course, the delivery hoses are connected, the couplings being of the instantaneous type patented by Merryweather's. Canvas hose was specially made for Mr. Francis by a Scottish firm, the Rob Roy Hose Company.

However, the manufacturers made a gift of the hose to Mr. Francis, in exchange for permission to use for publicity purposes a picture of the model in action. It is a sad commentary on human nature to know that the hoses have since been stolen by some vandal of a sneak-thief. They were kept in the lockers situated beneath the driver's seat and hose reel.

In all, there are five pressure-gauges, which were specially made for the model in Germany, being unobtainable in this country. So, incidentally, was the copper tubing, also from Germany. The pressure-gauges are used as follows; one on the boiler and another for the driver to see, one on the steam-to-fuel-oil line, one on the valve-chest of the power unit, and the final one on the chemical extinguisher unit.

There is a full kit of tools, including spanners and turn-keys, and the five oil-lamps all work perfectly, with the exception of that used to illuminate the gauge-glasses. This, the smallest of all, goes out when the front is closed, without doubt because of shortage of oxygen.

The gong on the front is electrically operated, and is $1\frac{7}{8}$ in. diameter.

Also seen on the front view of the model are three levers projecting above the apron in the centre; these are the reversing, throttle, and hand-brake levers. The hand-wheel on the right of the photograph is, of course, that which works the rear-wheel brakes.

The whole engine, as one would expect, is painted in red and lined out in gold, and all the brasswork—a considerable amount !—is brightly polished.

Without a doubt this model is fit to take its place among so many classics of the craft, which it has done at South Kensington. It must be a source of pride and satisfaction to Mr. Francis to know that his model has given, and will continue to give for years to come, so much pleasure and education to the general public.

Mr. H. A. Griffiths of Cardiff took the cover picture and the front and end views of the model, and I am much indebted to him for permission to use them. All the other pictures were taken well over forty years ago by a photographer whose name is now lost in the past, unfortunately. However, I must thank Mr. Francis for permission to reproduce them.

For the BOOKSHELF

Woodturning for the Beginner. By Alan Macbeth. (London: Percival Marshall & Co. Ltd.). Price 3s. 6d.

This is a new edition of a practical handbook which has already established itself as a worthy companion to *The Beginner's Guide to the Lathe* and other popular "P.M." publications. It explains in clear language all that the newcomer to this fascinating and useful craft needs to know to start him or her on the way to proficiency in the subject, starting with a chapter on the fitting up and furnishing of a suitable workshop. The different types of lathes, all of a simple and relatively inexpensive type, required for woodwork, are discussed, also useful attachment and tools, timber for turning, and methods of preparation and mounting in the lathe. After describing the technique of the subject, including the use of cutting tools, finishing and polishing, the book concludes with two appendices, dealing respectively with safety precautions in the workshop, and simple objects suitable for woodturning exercises for the beginner.

Chemical, Gas and Mining Engineering, Oil Prospecting and Production and Fuel Technology. (London, Her Majesty's Stationery Office). 72 pages, $5\frac{1}{2}$ in. by $7\frac{1}{4}$ in. Price 1s. 6d. net.

A revised booklet on chemical and mining engineering and fuel technology is now available in the "Careers for Men and Women" series issued by the Ministry of Labour and National Service.

The new booklet contains separate sections on gas engineering and on oil prospecting and production. All sections give revised information not only about the scope, pre-entry qualifications and training arrangements but also of the opportunities in the various branches of the engineering profession.

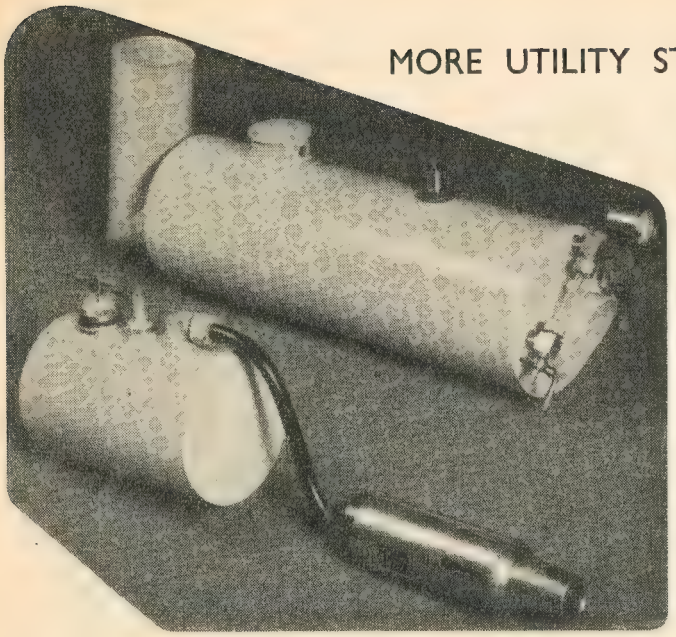
Here are some of the opportunities mentioned: *Chemical Engineering*—for those who have obtained the appropriate professional qualifications there is a variety of opportunities in the chemical, plastics, petroleum food processing or rayon industries, as well as with the engineering firms specialising in the construction of chemical plant. *Gas Engineering*—there are excellent pupilage schemes in the gas industry to encourage young men to become qualified gas engineers. In addition, a number of scholarships and fellowships are available to students in gas engineering and to graduates. *Mining Engineering*—there are opportunities for many additional qualified engineers required under the National Coal Board's "Plan for Coal." After graduation, young mining engineers going into the coal industry normally enter the National Coal Board's Directed Practical Training Scheme. *Metalliferous Mining*—for those who find it inconvenient to undertake the expenses of a full-time mining and engineering course, an official Learner Scheme is operated by several mining companies in South Africa.

Oil Prospecting and Production—this is one of the most vital industries in the world, and as most oil production engineers are employed by oil companies, many of the appointments are abroad. Fuel technology is becoming more important and the need for fuel technologists is increasing.

Appendices to the booklet give details of the main branches of engineering, educational facilities and the conditions of election to the various professional bodies.

The "Practical Mechanics" How-to-make-it Book. Edited by F. J. Camm. (London: George Newnes Ltd.) 224 pages, $6\frac{1}{2}$ in. by 9 in., 320 illustrations, price 12s. 6d.

This book describes a widely-varied assortment of devices which have been designed, built and tested in the "Practical Mechanics" workshop. They range from domestic aids such as a washing machine, a hand vacuum cleaner and a hand loom, to musical instruments, optical and photographic instruments and accessories, and mechancial devices. The many illustrations, mostly in the form of line drawings, make the descriptions easy to follow, and many of the items used in construction are obtainable on the surplus market.



A conventional form of centre-flue boiler, complete with blowlamp, by the Imperia Co.

Boiler Design and Construction

By Edgar T. Westbury

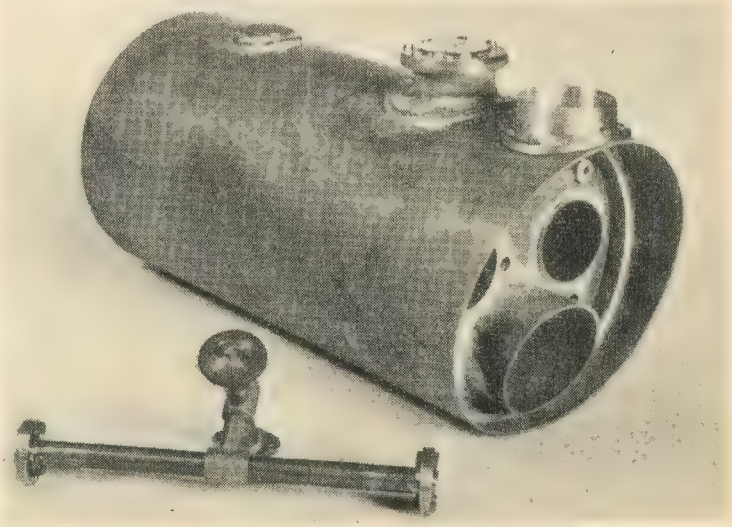
"SIMPLE questions demand simple answers"—so we are told; but there are many occasions when a question which looks quite straightforward on the surface cannot be answered in equally forthright terms. We are all familiar with the precious infant whose naive questions, fired with machine-gun rapidity, completely floor the most erudite of his elders. By the same token, the complete novice in model engineering matters is often very surprised to find that his "elementary" questions, so far from being answerable in a few words, cannot be answered at all in definite terms.

Two of the questions in this category, which arise very frequently in connection with small boilers, are "what size boiler do I require to steam an engine of *X* bore and stroke?" and "what is the most efficient type of boiler for use with an engine of (specified) type?" Despite the number of times I have had to deal with these problems, I am still hard put to it to produce concise answers which will satisfy querists.

To deal with the first question, this implies that there is, or should be, a definite relationship between the size of the engine and that of the boiler; which seems quite feasible, but is not necessarily true at all. As an illustration, I recall that when I was a boy, living in an agricultural district, a local farmer who had a traction engine which was used for threshing and other duties, decided to replace it with a more powerful one to cope with increased work. The new engine, however, did not seem to be any bigger than the old one, and on enquiry of the driver, I found that it had exactly the same bore and stroke. "Then why wouldn't the old engine cope with the extra work?" I asked. "Oh, 'er 'ud a-done the work all right" was the reply, "if 'er boiler could a-given 'er more steam!" Which, of course, is only another way of saying that the steaming capacity of a boiler must be related, not to the *size* of the engine, but to the amount of *work* it is called upon to perform. It is usual to rate full-size boilers in terms of horsepower, which is of course a logical principle, but difficult to apply to small steam plants where the h.p. figures are almost impossible to ascertain even to a moderate degree of accuracy.

But this is only a part of the story, because the steam-generating rate, or evaporative capacity, of a boiler is not governed by its physical dimensions either. The design of the boiler, its method of firing, and the area of surface exposed either to direct flame or conducted heat, all have a pronounced effect on the amount of steam produced. The term "effective heating surface" is often used glibly, on the quite unwarranted assumption that one can calculate which parts of the surface are or are not effective, and just how effective they are. Thus one can make little more than a shrewd

Continued from page 466 *April* 29, 1954.



The "Trident Mark I" boiler, with twin exhaust pipe and live steam blower

guess as to whether a particular boiler will steam a particular engine under a particular set of conditions. Most experts try to play safe by giving a "conservative estimate" which aims at keeping a good margin in hand, but they sometimes slip up badly, at that.

In the case of engines used for demonstration, it is usually sufficient to supply just enough steam to keep them turning at slow speed on no load; but if an engine is required to do a real job, such as drive a water pump, an electric generator, or a tractive vehicle, it will obviously require a considerably greater steaming capacity to do this successfully.

The answer to the second question is that all small boilers are inefficient, but some more so than others; and that in most cases efficiency is really of much less importance than convenience in dealing with the particular work in hand. Generally speaking, true efficiency, or in other words thermal efficiency, is incompatible with what is usually regarded as efficiency, that is, rate of steaming in relation to size or weight of boiler; the two factors may even be diametrically opposed. Thus a simple "pot" boiler, gently heated to produce steam at a slow rate, may actually make better use of the applied heat than a boiler with much greater area of heating surface, intensely heated to produce the maximum quantity of steam in relation to its size. This does not mean, however, that efforts to improve boiler design are futile, but simply that the type and size of the boiler should be related to the kind of duty, as well as the amount of work, that is required of it. For instance, in a fast model power boat, considerations of bulk and weight demand the use of a light, compact, rapid-steaming boiler; but such a boiler is quite uneconomical, besides being out of character, when used to steam a mill engine, no matter that it might be quite capable of doing so.

It may be that my answers to these questions, so far from providing a straightforward explanation, may be considered by querists as only adding to their confusion. But, as with so many other things in life, the seeker for "the simple answer" may eventually find that it does not exist, and that the only answer to a simple question is a multitude of more, and more complicated, questions.

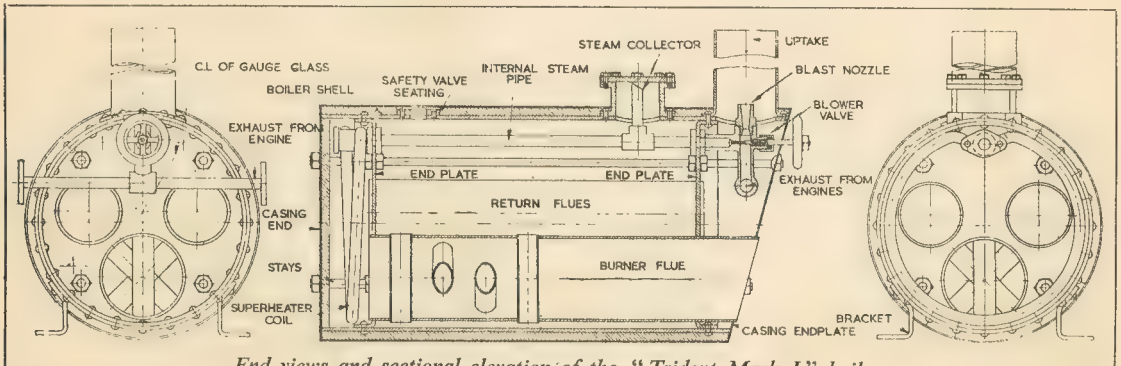
Evolution of Boiler Design

After the constructors of the early types of engines, which had "pot" boilers, shaped more or less like a witch's cauldron, and heated in an almost equally primitive way, discovered the limitations of these vessels, they sought to improve them, and one of the first ideas they hit upon was that of enclosing the entire furnace in the heart of the boiler itself. This was a logical development, up to a point, but improvement in thermal efficiency thus obtained was, from the practical point of view, secondary to the advantages it offered in respect of boiler construction, and the elimination of a separate external furnace structure.

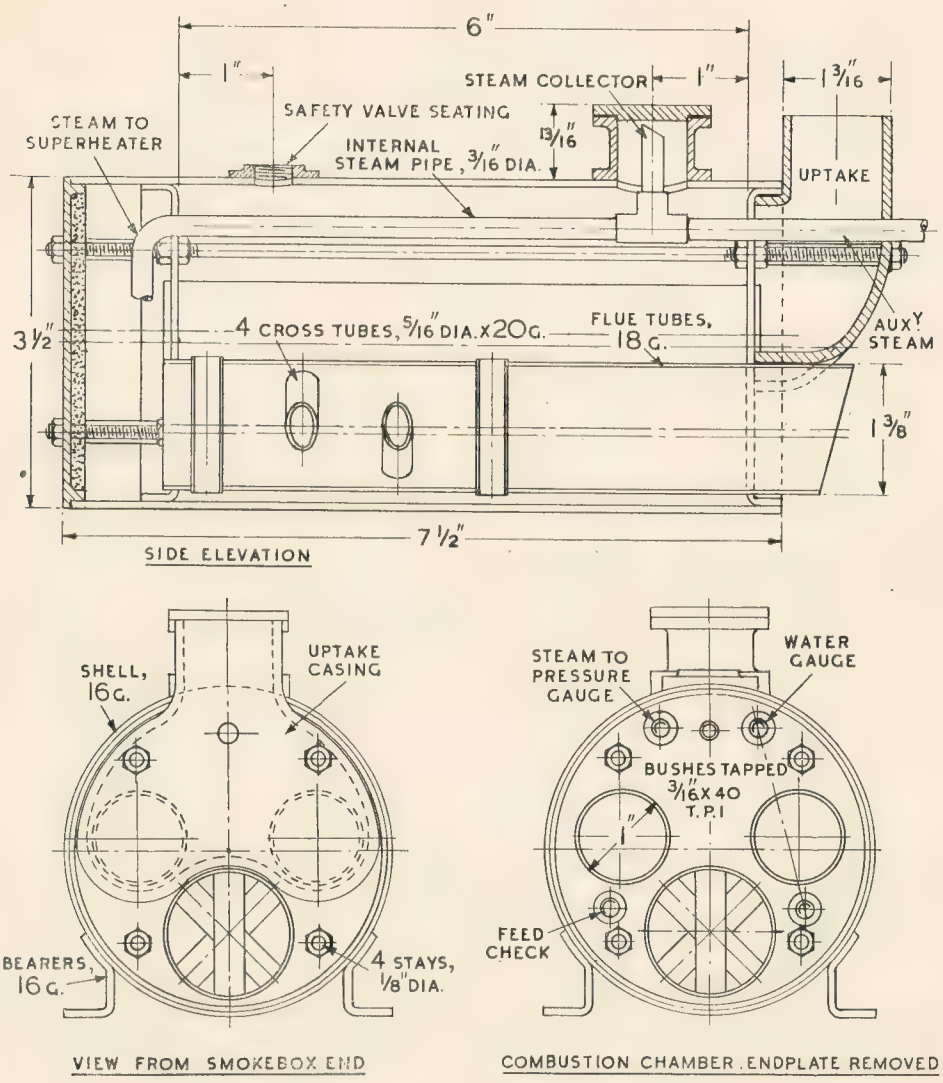
The most convenient shape for constructing the boiler was cylindrical, and this was also conducive to strength for resisting bursting forces; it was usually arranged horizontally, and its length was great in relation to girth, to enable a great deal of surface to be obtained in the furnace and flues; the latter were often continued on the outside, before the combustion gases were discharged to the chimney, and afforded still more heating surface. Thus were evolved the Cornish and Lancashire boilers, classic types which are by no means obsolete yet for stationary purposes. Where floor space was limited, vertical boilers could be employed, also having internal furnaces and flues, but modified in detail to suit this arrangement.

The value of increasing still further the heating surface was fully recognised, and the obvious way to obtain it was to split up the flues into a larger number of smaller passages, arriving ultimately at multitubular types of boilers; but the evolution of these was delayed by the difficulty of obtaining really sound tubes by the methods then available. In the case of marine engines, where the boilers had to be fitted into minimum space, a departure was often made from the cylindrical shape, and the "box" or "tank" type of boiler was evolved. This introduced a certain inherent weakness of structure, but boilers of this type were fairly successful for working at steam pressures up to 35 lb. per sq. in. They were often made of a width up to the maximum permitted by the beam of the ship, with multiple furnaces and flues. Higher pressures, necessitated by demands for increased engine power, compelled a return to the cylindrical shape, however, and that all too little-known marine engineering pioneer, Thomas Cochrane, tenth Earl of Dundonald, substituted for the internal flues banks of return tubes, which led to the design of the famous "Scotch" boiler which for many years was the most popular and successful of all marine types. Locomotive boilers evolved on generally similar principles, retaining the long cylindrical boiler, but with a short, deep firebox, and tubes leading to a front smokebox.

The evolution of model boilers has, perhaps quite fittingly, proceeded on similar lines to that of full-size practice, with due allowance for the fact that certain features cannot be



End views and sectional elevation of the "Trident Mark I" boiler



Sectional side elevation and end views of the "Trident Mark II" boiler

made to work successfully if scaled down in exact proportion; this applies particularly to the use of a multiplicity of tubes of small bore. As a result, most model boilers are more nearly comparable to the earlier and more primitive types, having either one or more flues, or a few tubes of relatively large diameter. Many attempts have been made to model the Scotch boiler, but they have met with little success in sizes suitable for use in the popular types of model power boats, even in cases where they are replicas only in external appearance.

It is rather significant that the most popular model marine boiler is still the "centre-flue" type, despite the fact that it has several serious inherent, and practically ineradicable, limitations. As I pointed out in the first series of "Utility Steam Engines," it is bulky and heavy for a given rate of steaming, to say nothing of the weight of water it contains; it cannot be forced to produce more steam, by extra intensity of heating, without risk of priming; and the amount of heating surface which can possibly be incorporated in it is small. Its practical virtues, however, are that its large steam and water reserve enables it to maintain a steady pressure and work for a substantial time without replenishment of feed; it has a low centre of gravity, and can be used as ballast in a hull of deep draught; and it is the type of boiler best suited to firing more or less efficiently with the orthodox torch type of blowlamp.

Most of the queries on boilers which I have encountered concern boilers of the centre-flue or comparable types, and within the last

year or two I have developed experimental boilers which embody the principles of these types, with certain practical improvements, both in construction and efficiency of working.

The first of these boilers, which I call the Trident Mark I, was intended specially for steaming a pair of diagonal paddle engines for a 6 ft. boat, and it may be found rather larger than will be required by most of my readers. For this reason, I do not propose to deal with it at any great length, but anyone who wishes to construct such a boiler can obtain fully detailed blue prints, and the photographs show the essential features of construction, most of which are common to both this and the smaller boiler. The shell of this boiler is 5 in. diameter by 11 in. overall length, the internal space between the endplates being 7½ in. long. It has one furnace flue 2 in. diameter, with four cross tubes ½ in. diameter, and two return flues 1½ in. diameter.

The Trident Mark II boiler is 3½ in. diameter by 7½ in. overall length of shell, but a separate smokebox is fitted which extends the length another 1¼ in.; the internal length is 6 in. It has one furnace tube 1⅜ in. diameter, with four cross tubes $\frac{5}{16}$ in. diameter, and two return flues 1 in. diameter. The marine engineer would probably describe these boilers as being of the "dry back" type, as they have combustion chambers at the back, like the Scotch boiler, but without "water walls"—in other words, not totally enclosed within the water space.

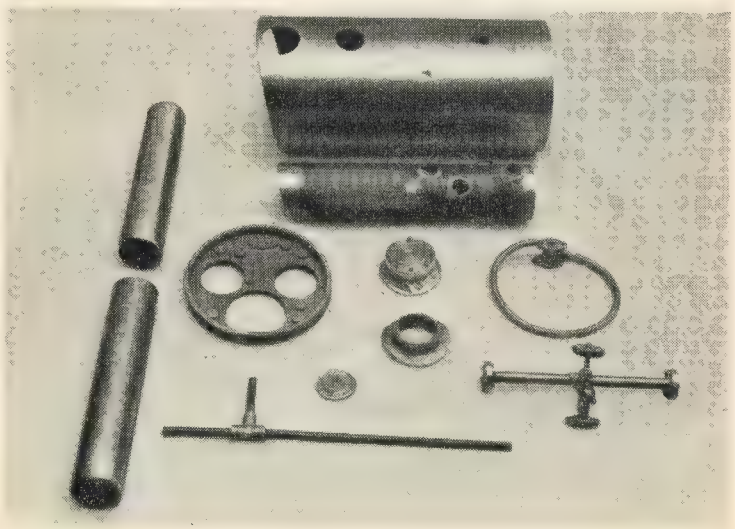
In adopting this particular arrangement of furnace and return flues, the object has been not only to obtain as much heating surface as possible without obstructing the flow of the gases, but also to give ample room for complete combustion. The smaller sizes of boilers, particularly those of the internal flue type, often have inadequate firebox space, and it is not uncommon to find that the most effective combustion takes place in the uptake—or even beyond it, though the latter phenomenon is not confined to any particular size or type of boiler, and may occur for reasons unconnected with the boiler design.

The structural design, and the methods adopted in the fabrication of these boilers, are intended to facilitate construction and remove some of the difficulties which are encountered by many who undertake boilermaking for the first time. Nowadays it is taken for granted that brazing or one of its allied processes will be used for fabricating any small boiler, and it is fairly certain that any other method would involve a greater amount of work, if not more actual difficulty. But the trouble about brazing is that it is so final and immutable; if one finds after brazing up a boiler that all is not well in some internal and inaccessible joint, it is next to impossible to dismantle the boiler (without mutilation, that is) to put the matter right. The methods I am advocating are not applicable to all boilers, and I want to make it quite clear that I offer no criticism of any other boilers which have been described in THE MODEL ENGINEER, either in respect of design or methods of fabrication advocated. But I have designed the Trident boilers in such a way that little or no mechanical stress is imposed on the brazed joints due to boiler pressure, and the brazing serves only to seal the joints against leakage. It has often been stated by boiler designers that there is no cause for any misgiving about the strength of brazed joints, as the brazing alloy has a higher mechanical strength than copper; and I do not challenge the accuracy of this statement.

But if I may be allowed to digress again into another anecdote of my misspent youth, I once knew a wheelwright who made a speciality of what he called "translation"—which had nothing to do with languages, but consisted of buying up old carts and wagons and turning them into new ones. On one occasion he was trying to interest a farmer in one of his refurbished and brightly painted vehicles, and his prospective customer, with characteristic caution, insisted on making a most minute inspection to ensure that it was sound in wind and limb. He soon discovered that there had been a liberal use of putty to stop up cracks and blemishes, and commented on the fact in no uncertain terms: "What's wrong with a bit of putty?" said the wheelwright. "Why, that stuff's stronger than wood!" "Maybe so," replied the farmer. "Then why don't you make the whole darn wagon out of it?"

To judge by some of the boilers I have seen the constructors seem almost to have achieved the ideal implied by the above farmer, by making them almost completely of brazing alloy! I make no comment on these achievements, except that there seems to be a case for simplifying boiler fabrication wherever it is possible to do so. In the "Trident" boilers, the major end pressure stresses are taken by four longitudinal stays, which pass completely through the boiler, and are extended beyond it where necessary to secure exterior parts. The entire inner assembly can be put together and brazed up, with all joints fully accessible both inside and out, before it is inserted in the outer shell. In the case of boilers which work at relatively low pressures (say up to 50 lb. per sq. in., which is sufficient for demonstration purposes, and for "scale-speed" prototype boats), it is unnecessary

(*Continued on page* 524)



Components of the "Trident Mark I" boiler before assembly

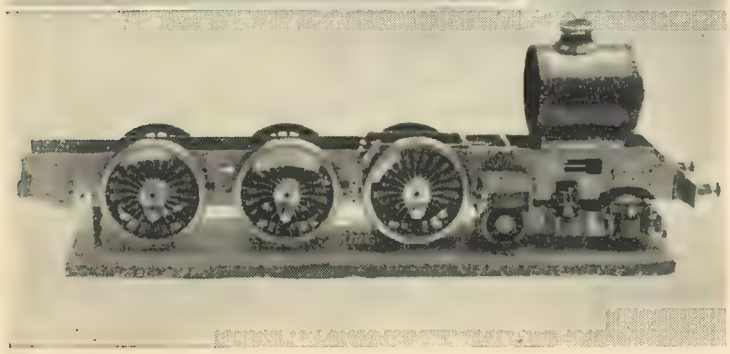
Final Review of the NORTHERN MODELS EXHIBITION

By "NORTHERNER"

A modified "Heilan' Lassie", built by Mr. E. Hinchliffe of Rochdale, won First Prize in the locomotive section

Left: As well as the Marine Trophy, Mr. G. W. Hinchliffe won two prizes for model guns; his Hotchkiss quick-firer is seen here

Below: Mr. D. Mapp is making a good job of his ¾-in. scale G.W.R. "King"



AMONG the locomotives at all exhibitions, the designs of "L.B.S.C." are invariably prominent; sometimes they are built exactly to the "works and music," but quite often the builder alters this or that to suit his own requirements or ideas. Such alterations may take the form of added detail or other embellishments; occasionally they involve a fundamental alteration in design which may or may not be successful, depending on the ability of the builder concerned.

The loco. exhibited at Manchester by Mr. E. Hinchliffe of Rochdale *was* built very largely to the instructions published for *Hielan' Lassie*, with very few alterations, which were only of a minor character. The most noticeable of these is the substitution of a single chimney for the double one, which was done to suit Mr. Hinchliffe's aesthetic taste; he doesn't like the double one's looks. Other alterations include the addition of certain detail work, and the substitution of three sets of Walschaerts valve-gear for the two-to-one gear.

Between four and five years has been spent on the construction; this is the builder's first attempt at locomotive building, except for a "Mollyette," though he has built certain petrol engines as well as workshop tools and attachments. The engine has not been run yet, but if she pulls as well as she looks she'll be all right. And talking of looks, the finish is very good: the paintwork consists of six or seven coats of Valspar enamel, rubbed down between each coat with "wet-dry" paper. The painting and lining were done by the builder.

A further point of interest is that the crank-axle was turned from the solid, a 3 in. dia. billet of 3% per cent. nickel-steel being used. The

cylinder covers and pistons are of dural.

Mr. Hinchliffe (who by the way is no relation to the winner of the Marine Trophy) has in his workshop a 4½ in. Harrison lathe, a home-built hand-shaper, which won a prize at a previous Northern exhibition, and a drilling machine.

Chassis for a "King"

The Great Western "Kings" are fine-looking locomotives, and one sometimes wonders that more models of the class are not seen. Mr. D. Mapp of Withington is one model engineer who has started to remedy the deficit, his chassis now being well advanced.

I have no information as to what drawings he is using, but Mr. Mapp appears to be making every effort to incorporate authentic working detail. The leading bogie, for example, is well detailed and correctly sprung.

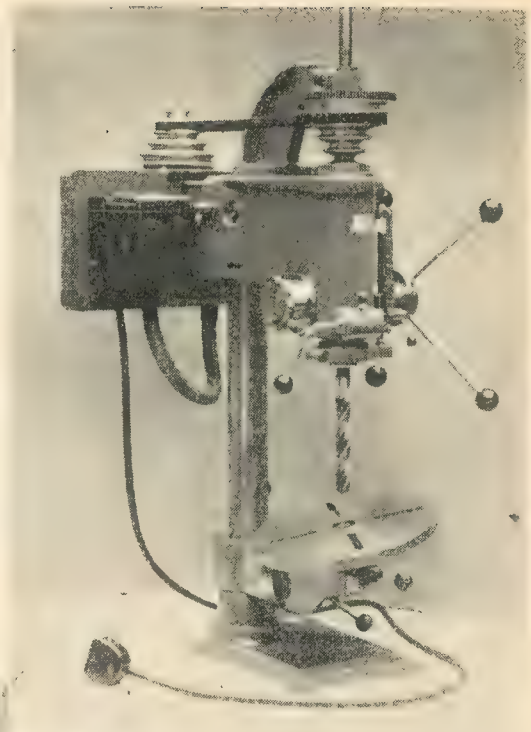
There is still a lot of work to do, naturally, but that which has been done has been done well.

The crank axle appears to be built-up, with the components press-fitted together, and twin pumps are driven from the centre axle.

Locomotives built to ⅜ in. scale are not nearly so popular today as they were twenty or thirty years ago: for "scenic" lines they have been largely supplanted, of course, by the smaller gauges. At the same time, a gauge "1" locomotive can incorporate a great deal that must be omitted from the "miniatures." The ⅜ in. scale L.M.S. tank being built by Mr. A. T. Trotter of Stoke-on-Trent is a case in point. It incorporates a fully-detailed backhead, reversing-screw and handle, driver's seat and brake-handles in the cab, whilst external *minutiae* include rows of rivets, tiny engraved maker's name-plates, a hinged smoke box door, and dummy mechanical lubricators. This model was awarded Third Prize in its class, and in passing it may be mentioned that Mr. Trotter's cabin-cruiser *Ivy May* won Second Prize in the radio-controlled models.

A "History" of the L.N.W.R.

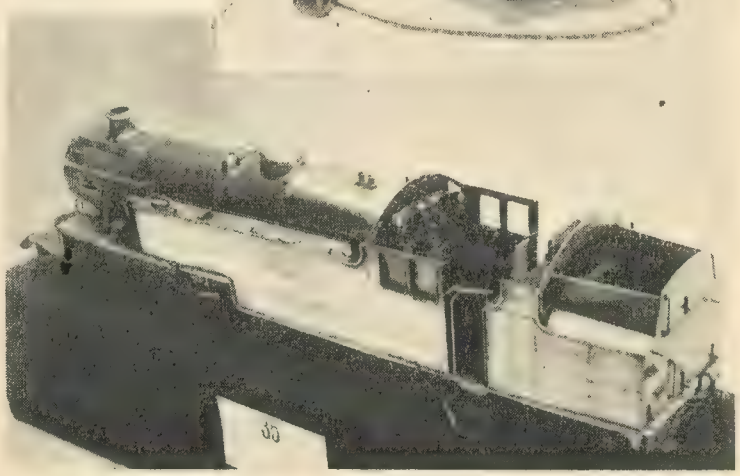
Also on the locomotives stand were three engines which might be termed a historical survey of some of the passenger locomotives of the L.N.W.R. They were all built to 3½ in. gauge, and the first was a 2-4-0, the "Jumbo" of 1874, built by the late Mr. V. E. Sherwood in conjunction with Mr. J. Moss. The latter genial gentleman (whose looks and vitality belie his more than seventy years!) was responsible for the other two engines, which were the outside-cylindered 4-4-0 *King Edward* VII of 1900 and the inside-cylindered 4-4-0 *George the Fifth* of 1910. These were three nice-looking

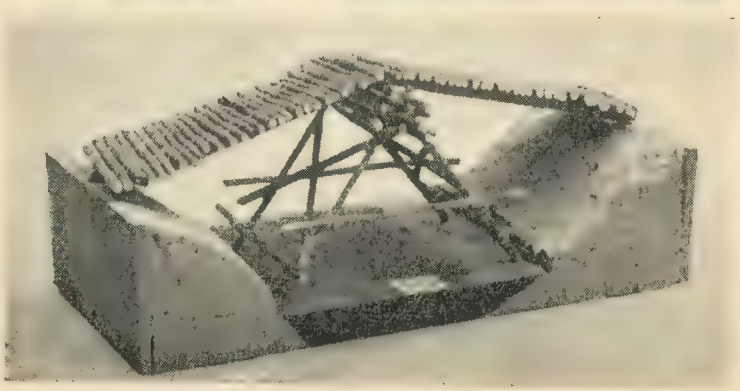


Mr. R. Gardiner's drilling-machine was awarded the Harper Trophy for the best item of workshop equipment

Below: Gauge "1" is not common in these days, but it does give an opportunity for detail!

This model of a primitive trestle-bridge (bottom of page) was quite realistic, and was built by a schoolboy, D. B. Williams





engines whose black liveries evoked boyhood memories for me, and I was sorry I could not spend longer in talking to Mr. Moss, whose encyclopaedic knowledge of engines in general was most entertaining and informative.

An Old Model Locomotive

Most of us are interested in old models, and I was especially in a 3½ in. gauge engine exhibited by Mr. T. F. Irving of Cuddington. It was built by his grandfather, and bears the nameplate "T. Hall, Maker, 1897." It also bears a legend "G.E.R." on the side of the tender, but is not finished in G.E. colours, the livery being green with red lining. There is also plenty of brass-work, as might be expected of the period : the chimney is polished brass, with a copper cap, and the dome and safety-valve bonnet are also brass.

The frames and motion are very light by modern standards, but I was assured that the engine works well under air-pressure. Brass wheels are used, and these were cast by the builder himself. The boiler is riveted and soft-soldered, and contains five ¾ in. flue-tubes, which are beaded over. On the backhead are a water-gauge, as well as high and low-level cocks; there are two whistles.

Other fittings include side-tanks, with a hand-pump operated by a lever in the cab, and the cylinder drain-cocks are also worked from the cab. Steam brakes are fitted, with a screw-down hand-brake on the tender. Reversing is by Stephenson link-motion, and spring buffers are used.

Another "accessory," not perhaps so conventional as those already listed, is a dummy fireman, whose strong right arm automatically and vigorously wields a coal-hammer as the engine goes on its way ! He never tires, but presumably his strength is derived from a crank or eccentric on one of the tender axles. There is also a driver, by the way, but he was not exhibited.

In the workshop tools section, the First Prize and the Harper Trophy were won by Mr. R. Gardiner of Littleborough, with a useful drilling machine. It was a solid looking job, and the parts were well "fitted," which should ensure a long life with accuracy. The machine has four speeds, and is being fitted with back gear to add to the range. An unusual feature is that the motor platform is fitted on slides, and by means of a lever-operated cam action the belt can be slackened off. This will not only obviate much switching off, but affords a ready means of adjusting the working belt tension. The work-table may be tilted and revolved, and a depth-gauge is fitted to the quill, with a "sight" which can be adjusted and locked in place. Finish was good on both machined and enamelled surfaces.

That veteran model engineer of Preston, Mr. G. W. Hinchliffe, had his three model guns at Manchester, and with two of them won the Second and Third Prizes in the General Models. The most impressive of these was the 3-pounder Hotchkiss, whose overall length was 28 in., with a calibre of ½ in. The barrel is rifled, and the model has recoil action, correct elevating and training motions, as well as other detail. A feature of Mr. Hinchliffe's guns is that in the interests of safety he has had the barrels "proved" at Woolwich, and they bear a Government stamp in consequence.

Lastly, among the many and varied Junior exhibits, there were two models of primitive bridge-building. These were not prize-winners, probably because the finish was not up to the required standards, but they did create interest. The first was a trestle bridge in which the decking is supported by a triangulated structure which, in turn, was supported by the river-banks. This was built by D. B. Williams, a schoolboy of Timperley. Secondly, there was a trestle suspension bridge, in which the walk-way—it could hardly be termed decking !—was suspended from trestles erected on each bank. Another schoolboy, A. Sherratt of Altrincham, was responsible for this model.

Both the bridges were built in a realistic manner, with "bamboo" rods bound together, and without joints or nails—in fact, just like the way in which the primitive builders of the prototypes built them.

BOILER DESIGN AND CONSTRUCTION

(*Continued from page* 521)

to braze the inner assembly into the shell. As the joint around the rim of the endplate is not exposed to direct combustion heat, it may be sweated with soft solder, provided that it is a good fit and has been tinned before insertion. A few rivets or screws around each joint will add further security, but are not really necessary to resist stress.

Both these boilers may with advantage have cast bronze endplates, but if so, they should be thicker than the flanged sheet copper plates shown, to ensure soundness—not less than ⅛ in. thick, I suggest. The bosses for fittings may be incorporated in these castings, both endplates being made alike, so that the fittings may be located at the most convenient end. Castings may also be used for the external plates which close both ends in the Trident Mark I, also the combustion end, and the smokebox of the Mark II, aluminium being recommended to avoid excess weight. The inside of the combustion endplate is lagged with asbestos millboard in each case, to cope with possible flame impact.

The Mark I boiler is provided with an exhaust blast pipe and auxiliary live steam blower to suit the installation for which it was primarily designed, but this of course is optional, and a similar fitting can be added to the Mark II if desired. In the former, flange joints were specified at both ends to connect up the blower and the main steam pipe respectively, with a separate header to carry the superheater coil, but in the smaller boiler it will simplify matters to continue the internal steam pipe outside at both ends, coiling it inside the combustion chamber to form a superheater, and brazing it into the endplates at both ends

The internal steam pipe is fitted with a tee-piece to take a vertical steam collector pipe which ensures that steam is taken from the highest possible point. Bronze castings may be used for the dome and its cover, also the safety-valve seating, and any other external fittings which may be added on the outside of the shell.

In the construction and development of these boilers, I have had valuable practical assistance from Mr. L. Gansell, of the Imperia Co., 4, Cranbrook Road, Ilford, who also produces other boilers of his own design, an example of which is illustrated herewith. Perhaps I should point out that the grey enamelled finish on the boiler and blowlamp container is not standard practice; they are normally finished in matt black, but it is almost impossible to obtain satisfactory photographs of them in this condition, so it was found desirable temporarily to apply a more "photogenic" colour.

(*To be continued*)

Two new M.E. Exhibition Trophies

The "Model Engineer" Students,Cup

TO encourage model engineering among students and apprentices, the directors of Percival Marshall & Co. Ltd., have inaugurated a new Cup to be presented for the first time at The "Model Engineer" Exhibition this year. This will be known as THE MODEL ENGINEER STUDENTS' CUP and will be won outright each year. Any piece of model engineering work made collectively or individually, by a class or member of a class, of any school or technical college, or by a full-time engineering apprentice under the age of 18 at the date of the Exhibition, will be eligible for entry.

The term "model engineering work" shall be taken to include models of engines or mechanical devices or their components; model ships, aircraft, architecture; tools and equipment; horological or instrument works; pattern-making in wood or metal and examples of crafts-manship entailing the use of normal engineering tools, materials and processes. Entry, which is free, must be made on the official entry-form, and a separate form completed for each entry. Each form must be signed or endorsed by the school-master or instructor.

Entry-forms may be obtained on application to the Manager, The "Model Engineer" Exhibition Offices, 19/20, Noel Street, London, W.1, and must be completed and returned to him not later than Monday, July 5th, 1954.

No entry which has already competed at any of The "Model Engineer" Exhibitions can be accepted for competition. Competitors must state on the entry-form: (a) Any parts or kits which have been purchased or are not the outcome of their own work. (b) The origin of design.

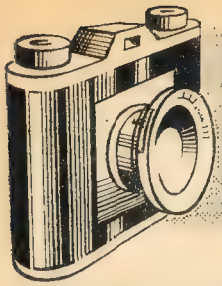
All models will be insured for the period during which they are at the exhibition and in transit to and fro, provided they are adequately packed and the instructions regarding their despatch are correctly observed.

The directors reserve to themselves: (a) the right to refuse any entry or model on arrival at the exhibition, and shall not be required to furnish any reason for so doing; (b) the right to exercise or delegate, the exclusive rights to describe and photograph any models entered for competition or display and to make use of any such photographs or descriptions in any way they may think fit. (This reservation does not apply to photographs taken for publication in daily or local newspapers.)

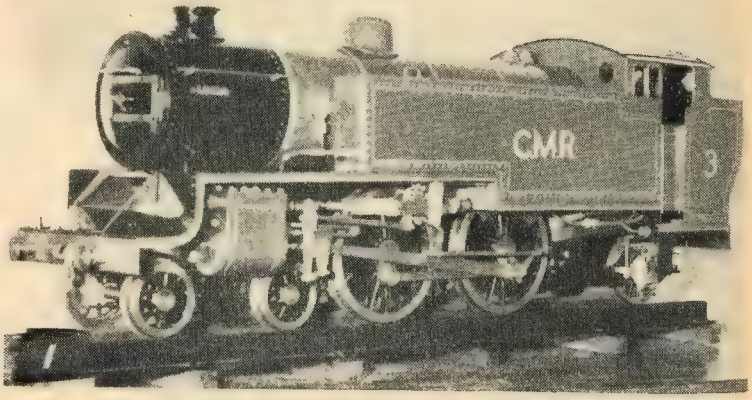
Competitors will be entitled to a free Competitor's Pass to the hall during the Exhibition. Passes will be sent or given to the exhibitors when the models are received at the hall. (These passes are not transferable.)

As a further incentive, Exide & Drydex Batteries Ltd. have presented a Challenge Cup which will be awarded annually to a student or apprentice, for the best entry which incorporates a battery.

The Exide and Drydex Batteries Ltd. Challenge Cup



Focus on Readers' Work



WE are pleased to introduce a feature which, it is hoped, will be repeated in many future issues of THE MODEL ENGINEER. We believe that the true enthusiast is always interested in other people's work, but at the same time we would emphasise that his own efforts should not remain in obscurity. The feature may well serve as a "stock exchange" of talent, instruction and example, and no one should be shy about sending details—and a few good, sharp, fairly large photographs—of past or present work. The usual rates of payment will be made.

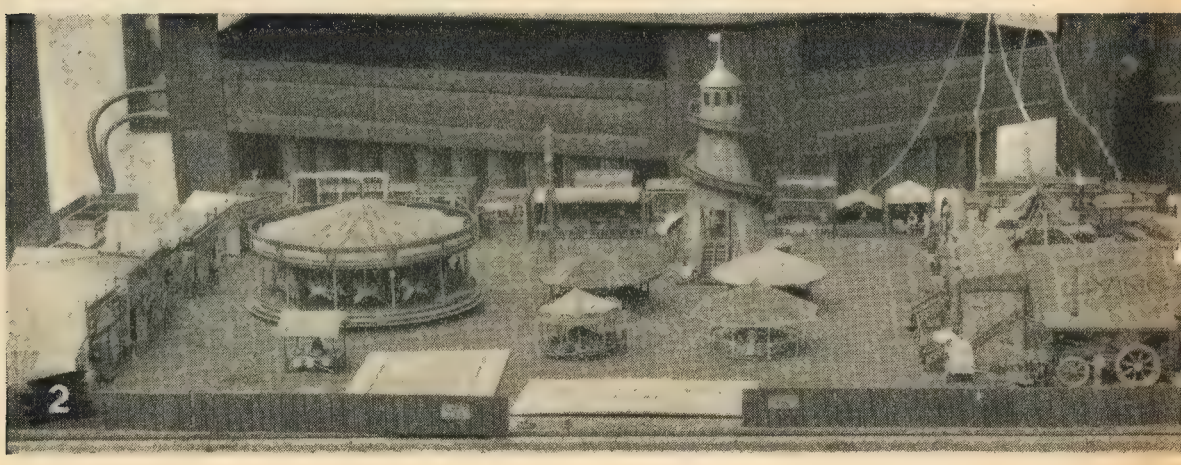
The examples on these pages are not exceptional, or in any way special, but represent a reasonable selection of "bests" from matter sent in, in the normal course of events, in recent weeks. Neither is there any significance in the fact that No. 1 is a locomotive. It might equally well have been a boat, or car—or a sewing machine, or a bacon slicer, if anyone cares to model such objects !

Pretty little *Linda*, the 3½-in. gauge free-lance locomotive, is currently under final tests on the Croft Model Railway in the Cambridge area, and was built by Mr. A. Palmer, a member of the Cambridge & District Model Engineering Society. The freelance design is built around "L.B.S.C.'s" new *Maisie* boiler with multiple-element superheater, etc. The locomotive is tank-type, to make it easier to transport to fetes, etc. The side tanks hold half a gallon of water. On initial tests the engine—which was built in two years of spare time—gave good results at once. A foot-pump-operated spray gun of home manufacture was used for painting the model, because it was found that brush painting resulted in "runs" from the many rivets.

Photograph No. 2 shows a model set-up which appears to lack only the "milling throng" beloved of the early novelist ! This ¼-in. scale old English fair is the work of Mr. M. C. B. Arthur (Bolton & Dist. S.M.E.) and has been a first prize winner. Latest addition to the fairground attractions is a set of steam swings (or, in contemporary phraseology "steam yachts") which operate in a realistic fashion through the agency of an electric motor.

The model is mainly constructed in metal, although a certain amount of wood is used. Perhaps Mr. Arthur ought to consider commissioning Mr. Cranch (see No. 3) to do some pin-sized Winchesters ! Most of us are susceptible to the fascination of the fairground, with its blaring music, throaty "barkers" and whooping sirens, and this model conjures up the sights and sounds—and even the smells of steam and hot oil, cartridge-smoke and trampled grass.

The model of a 12-15 B.S.A. rifle (Photograph No. 3) made by Mr. J. W. Cranch, of Salcombe, Devon, is now a trophy held by his local rifle club. It is of ¼-in. scale, being just over 11 in. long, and Mr. Cranch is frank enough to admit to one failure—i.e., that he did not manage to through-bore the barrel, and had to be satisfied with blind drilling at each end. The barrel



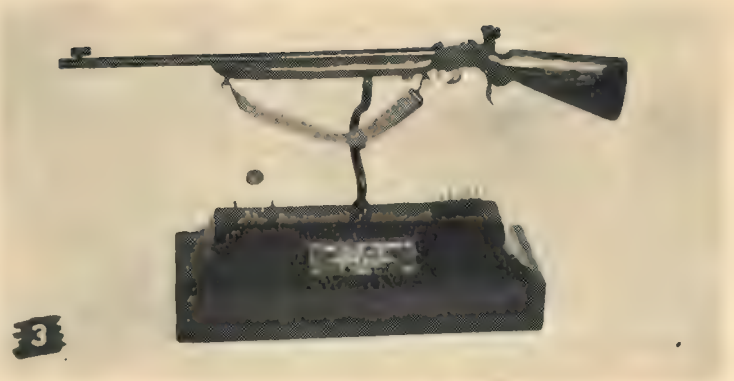
tapers from $\frac{1}{4}$ in. to $\frac{3}{16}$ in. and is just over 7 in. long, the bore being $\frac{1}{16}$ in. Could it be bored successfully without special equipment? Mr. Cranch would like readers' views.

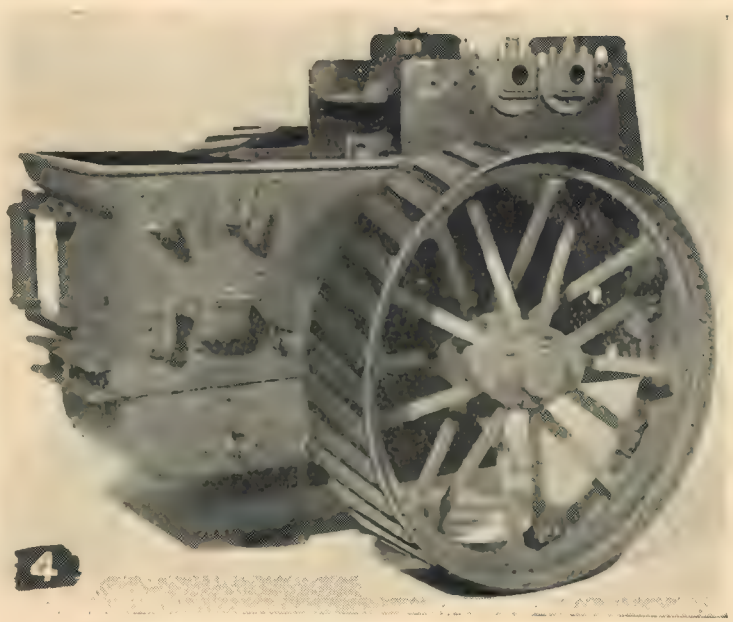
Trickiest job was making the action, but Mr. Cranch brought this "pleasant pain" upon himself, because although he had intended a dummy mechanism, he couldn't resist making each part workable, and eventually realised a complete working replica.

Photograph No. 4 is that of the tender of an almost-complete $1\frac{1}{2}$-in. scale "Allchin" made by the chairman of the Sevenoaks Society, Mr. S. J. Crouch. Wheel rims are of mild steel, and were mounted on a faceplate for turning. Tender-sides were beaten around a cast former, and first and second-shaft bearings had to be precision-fitted, as there is no provision for vertical adjustment.

Photograph No. 5 shows a fine 5-in. gauge "Royal Scot"-class locomotive, built by Mr. George Archer, of Warrington. This engine represents the prototype as rebuilt with tapered boiler, but Mr. Archer has used only a single chimney because he likes the look of it better than the double one that is fitted to the prototype. The excellence and precision of the workmanship and finish are not only remarkable, but are typical of Mr. Archer's methods. The engine is very powerful and has run many miles without giving the least trouble.

And these, we hope, are potent appetisers. We look forward to a steady supply of material for what we feel sure will be a popular feature. There are no reservations as to subjects, but photographs must, of course, be suitable for reproduction.


3


4

5

IN THE WORKSHOP
BY DUPLEX

Constructing an Engraving Machine

THE engraving head is mounted on the pantograph frame so that it is rigidly supported in the vertical plane, but is quite free to move horizontally ; in this way, the cutter will follow exactly the movements of the tracing stylus, also attached to the pantograph. The head mounting consists of three components : the bracket Da attached to the machine column, the intermediate link-bar Db, and the head link-bar Dc. The lay-out of this assembly is shown in Fig. 29, but here, for the sake of clarity, the connection to the pantograph frame has been detached.

Continued from page 469 April 29, 1954.

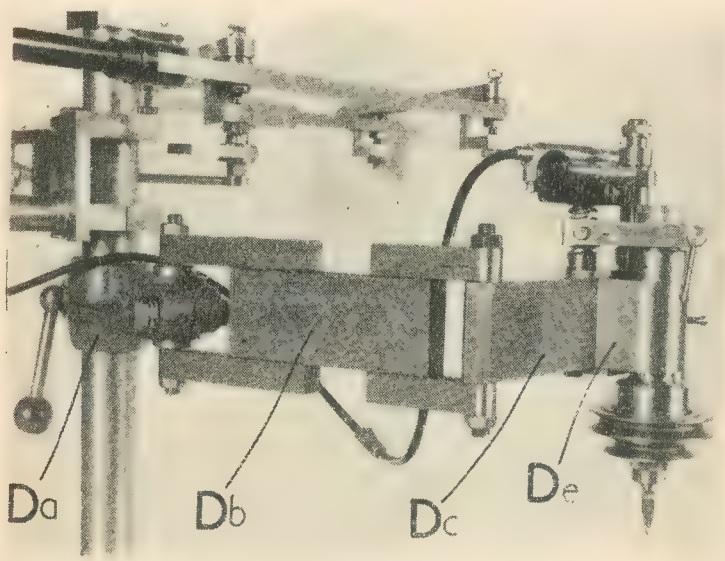


Fig. 29. The cutter head mounting. Da—the column bracket; Db—the intermediate link-bar; Dc—the head link-bar; De—the head bracket

The Column Bracket Da

This component was machined from a casting forming part of Messrs. E. W. Cowell's $\frac{3}{8}$ in. drilling machine. Both ends are slit and cross-drilled for clamping-bolts, and the $\frac{3}{4}$ in. dia. pivot spindle shown in Fig. 30, is clamped in the small-end of the bracket to form a hinge-pin for the intermediate link-bar. After being centre-drilled at either end to form a bearing for the pivot screws, the pivot spindle is case-hardened, and the bearing centres are afterwards polished with an emery stick, consisting of a pointed piece of hard wood charged with a mixture of oil and a fine abrasive.

The Intermediate Link-bar Db

As shown in Fig. 31, this component is built up from four $\frac{1}{2}$ in. square bars, each of which is secured by means of two Allen cap-screws to a central member made from $1\frac{1}{2}$ in. × $\frac{1}{2}$ in. mild-steel bar.

The four $\frac{5}{16}$ in. B.S.F. coned pivot-screws have their points hardened and polished and, after adjustment, are secured with lock nuts.

The Head Link-bar Dc

This part also is made from $1\frac{1}{2}$ in. × $\frac{1}{2}$ in. mild-steel bar, and at its inner end it is centre-drilled to form

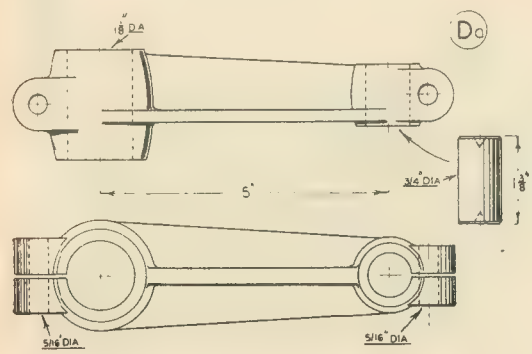


Fig. 30. The column bracket and hinge spindle

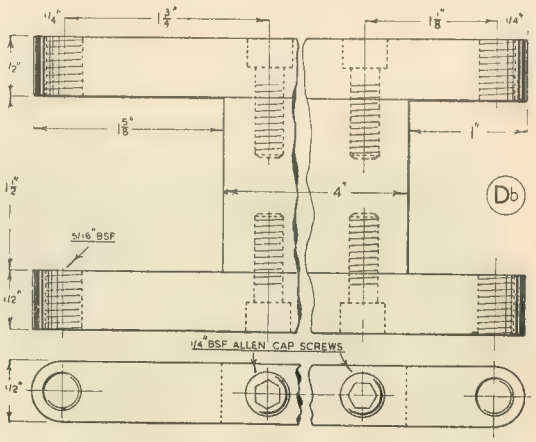


Fig. 31. The intermediate link-bar

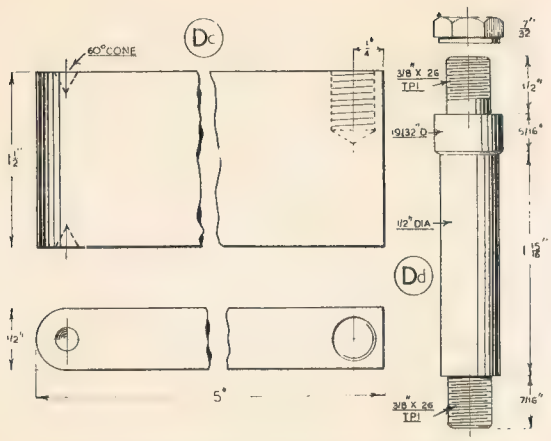


Fig. 32. The head link-bar—Dc, and its spindle—Dd

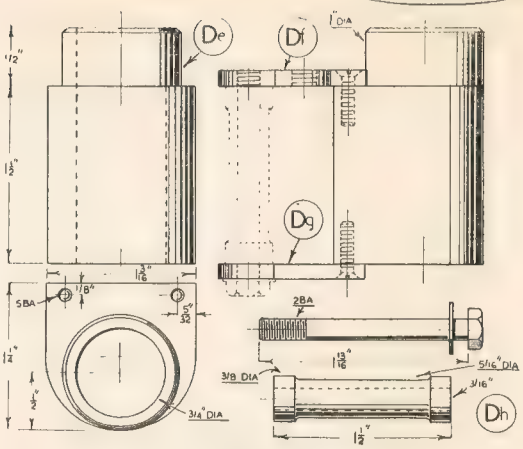


Fig. 33. The head bracket—De, with its upper and lower attachment plates—Df, and—Dg; the clamp-bolt and sleeve—Dh

bearings for the two pivot-screws fitted to the previous component. At its outer end, the link-bar is drilled and tapped for the spindle Dd. This spindle at its upper end engages in the short link Dl which, in turn, is connected to the pantograph frame by means of the box clamp Dj.

As will be seen later, this spindle also serves for the attachment of the mechanism for raising and lowering the cutter head and setting the depth of cut.

The Head Bracket De

This bracket was machined from the solid and, as will be seen in Fig. 33, it is clamped to the head link by means of the upper and lower plates Df and Dg. These plates are fixed to the head bracket with either countersunk or cheese-head screws, and the mounting so formed is tightened on the head link by a clamp-screw fitted with a tubular distance-piece Dh. The additional hole in the upper plate,

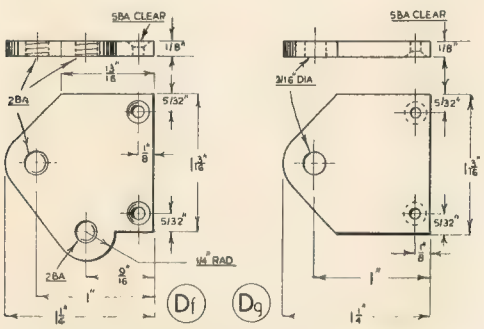


Fig. 34. The upper and lower attachment plates

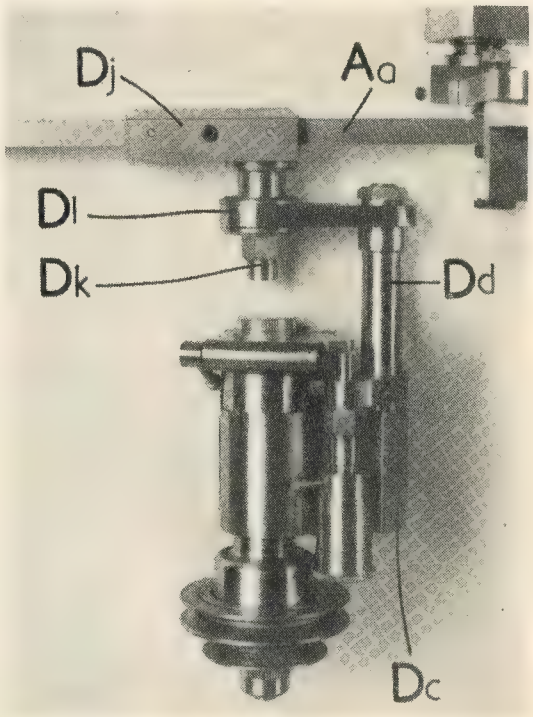


Fig. 35. Aa—the pantograph frame; Dc—the head link-bar and spindle—Dd; Dj—the box clamp; Dk—the box clamp spindle nut; Dl—the short link-bar

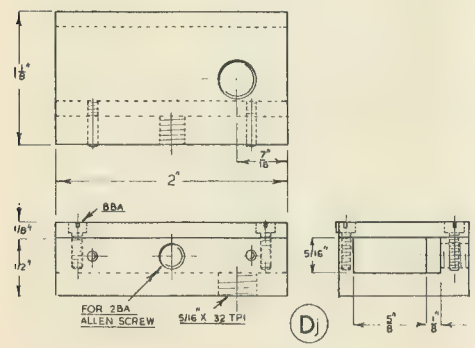


Fig. 36. The pantograph frame box clamp

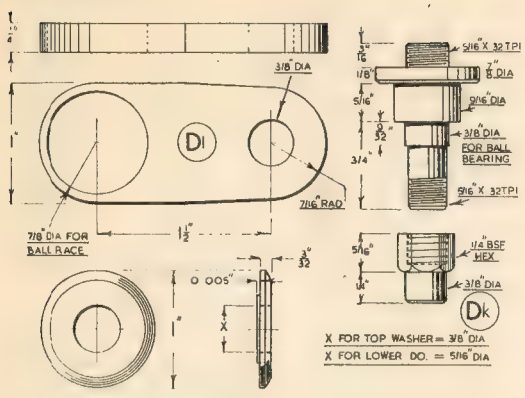


Fig. 37. The short link-bar with its spindle, and the ball-bearing clamping washers

tapped 2 B.A., will be used later for mounting the screwed spindle that serves to raise and lower the cutter head. As the lapped body of the cutter head should be made an accurate sliding-fit in the head bracket, the latter part is also finished by lapping to size ; this will ensure smooth, shakeless working when the cutter is fed into the work-piece.

Connecting the Cutter Head to the Pantograph

For this purpose, a box-clamp Dj, secured to the pantograph arm Aa, is fitted with a pivot spindle Dk for carrying the link Dl which, in turn, is connected to the spindle Dd. The box-clamp is made in the same way as the previous clamp used for mounting the pantograph frame on the machine column, but the lower plate of the present clamp is drilled and then tapped $\frac{5}{16}$ in. × 32 t.p.i. for mounting the spindle Dk. In order to reduce working friction, the link Dl is mounted on the spindle Dk by means of a $\frac{3}{8}$ in. ball-bearing of the standard light type. The inner race of this bearing is fixed to the spindle by the clamp-nut shown in the drawing, and the outer race is made a light press-fit in the large end of the link Dl. The two $\frac{7}{8}$ in. dia. washers illustrated, besides clamping the inner bearing race, form a shrouding to keep out dust. It should be noted that these washers are formed with a small shoulder, so that they bear only on the inner ball-race. At its lower end, the clamp-nut is shouldered to provide a parallel bearing surface for the radius arm which, as will be described later, serves to maintain the distance between the driving motor and the cutter head.

A Trial Run

The machine, so far constructed, can now be given a preliminary trial. But first of all set the axis of the cutter spindle directly in line with that of the box clamp spindle Dk.

Next, the centres of the spindles of the two box clamps and the centre of the stylus are set so that they lie on a straight line. In this way, two geometrically similar triangles are formed by the components of the machine and, as a consquence, any letters engraved will be counterparts of those on the guide stencil.

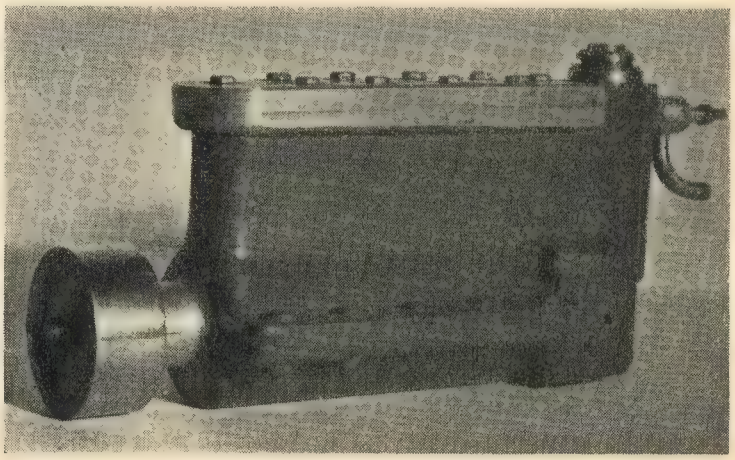
The scale of reproduction depends on the relative positions of the two box clamps on the arms of the pantograph frame, but the method of making these settings and graduating the pantograph arms will be described at a later stage when adding the finishing touches to the machine.

Insert a short length of lead pencil in the chuck of the cutter spindle, and allow the weight of the cutter head to press the pencil on to a piece of card clamped to the work table. With the stylus engaged in a Uno stencil mounted on the tracing table, trace a series of letters on the card and, if the machine has been properly set up, these letters should be accurately formed and exactly proportional to those on the stencil.

(To be continued)

A FOUR-CYLINDER STEAM ENGINE

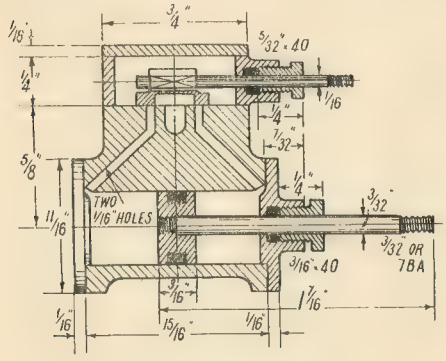
Mr. W. T. Baddeley, of Crestview, Drossie Road, Falkirk, Scotland, has submitted for our inspection a sample of a single acting four-cylinder steam engine, $\frac{1}{2}$-in. bore by $\frac{5}{8}$-in. stroke, which he is producing, either in finished form or as a set of castings. This is of ingenious design, the cylinders being disposed vertically in line, in a monobloc casting, and all working parts totally enclosed, with sump lubrication. Steam distribution is by means of a disc rotary valve, operated from the end of the crankshaft, and free to float so as to find its own seating. A displacement lubricator for cylinder oil is incorporated in the main casting. We have tested the engine on compressed air, facilities for running it on steam not being available; it runs smoothly and silently on 20 lb. per sq. in., and is self-starting. As the valve and its seating are of aluminium alloy, it would appear to be suited only to run on saturated steam at moderate pressure; for heavier duty, harder and more durable material for these parts would be desirable. As a power unit for a model boat or similar purposes, however, the engine has interesting possibilities.



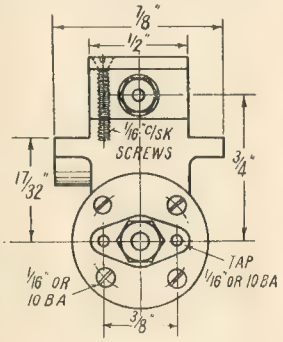
L.B.S.C.'s "Netta"

A NORTH-EASTERN T-CLASS "MITEY" HAULER IN FIVE GAUGES

THE cylinders that I am specifying for the whole family of quins, are of the simplest possible construction consistent with efficiency. Each cylinder is a self-contained unit, complete with steam-chest and valve, and is attached to the frame by a flange at top and bottom. When first getting out the details of cylinders and motion, I contemplated using, for the baby quin, a design I tried out over 30 years ago, in which both cylinders and part of a horizontal steam-chest, were cast in one piece; but drilling the steam ways might have been a ticklish job for beginners, though the valves could be set by sight with the engine turned upside down. For the 1¾ in. and 2½-in. gauges I thought about using the circular type of steam-chest first conceived by the late Mr. T. W. Averill; but this restricts the valve travel, unless circular valves (as used in days gone by, on some full-sized engines designed by Messrs. F. W. Webb and Massey Bromley) were used, together with moon-shaped ports. My old *Ayesha* has this type. If a common steam-chest is used for the bigger quins, difficulty arises in machining the flange of the steam-chest; so after making a lot of hieroglyphics on my development drawings, I decided that the simplest would be best, and here they are.



Section of gauge "O" cylinder

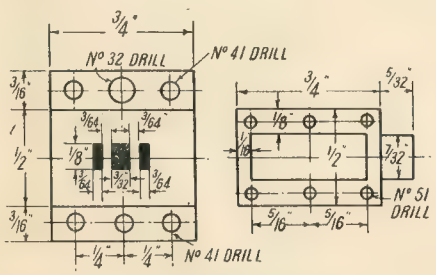


Back end of gauge "O" cylinder

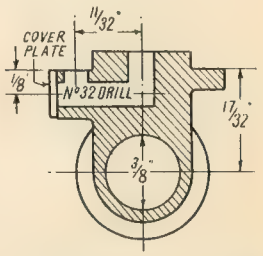
Boring and Facing

As both the smaller sizes are of similar pattern, one set of descriptive notes should be sufficient, though I have made separate drawings, so as to avoid possible confusion. The baby quin's cylinders are ⅜ in. bore and ⅝ in. stroke; and in this wee size, it would save time and labour if they are cast solid, without any coring. For the boring job, it would only be necessary to chuck the casting in the four-jaw, with one of the flanges running truly. The outer flange should overhang, so that it can be machined; and if a bit of packing is placed between the cylinder barrel and the chuck jaw a firm grip will be ensured. Face off the flange, centre, drill a small pilot hole, say about ⅛ in. and open it out with 23/64-in. drill, finishing with a ⅜-in. parallel reamer. May I remind beginners that this should be run through non-stop, or the bore will probably be ringed. Put the reamer in the tailstock chuck, and feed by sliding the tailstock bodily along the lathe bed—in, out! as the radio commentator would say when describing the Boat Race. When facing the flange, take off just enough to keep both flanges the same thickness; e.g. if the overall length of the casting is 1 in. then face 1/32 in. off each end. The second flange is machined by mounting the bored cylinder on a stub mandrel held in the three-jaw; any odd scrap of brass rod of requisite size, can be chucked and turned down to a push-on-tightly fit for the cylinder. If a beginner turns the stub too small, all he need do, is to wind a turn of paper around it, and he will have an uncle named Bob. Finish the edges of the flanges to a shade smaller diameter than the covers; this will allow for a thin cleading plate to fit between covers on the finished job.

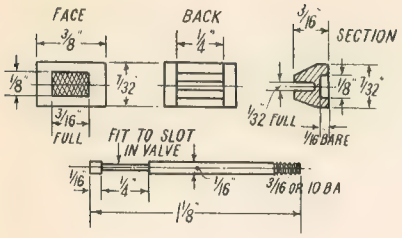
If the available chuck is large enough to take the Gauge "1" castings, the same procedure can be followed for that size. It doesn't matter whether the cylinder castings are cored, or not. If they are, no pilot hole will be needed, and a ½-in. drill can be put straight through; this will clean out the core hole. The flange can then be faced and



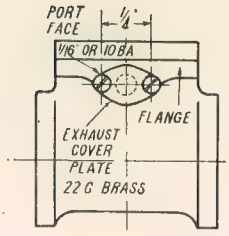
Portface and steamchest—gauge "O" cylinder



Section through exhaust port—gauge "O" cylinder



Slide-valve and spindle—gauge "O" cylinder



Plan of gauge "O" cylinder

turned to size, and the bore finished with a boring-tool and reamer, to ensure accuracy. Mount a boring-tool in the slide-rest, and bore until the "lead" end of a $\frac{9}{16}$-in. parallel reamer will just enter. Again, beginners please remember that a reamer is a *finishing* tool, intended to scrape out the last thousandth or so, so that the reamed hole is dead true and parallel throughout its length. If you force it through a hole that is too small, the result will be anything but true. If no reamer is available, the casting should be bored to $\frac{9}{16}$ in. diameter, the last two or three traverses being taken without shifting the cross-slide. If the lathe has a self-acting feed, or screwcutting gear, use it, with the slowest possible feed that can be set up by the available change-wheels. I find that there is a peach of a "slow-coach" (just the reverse to super-sonic!) on the Purley Locomotive Works Myford, using the 12-tooth pinion on the reverse cluster, and the 100 wheel on the leadscrew, with suitable wheels in between. If the lathe only has a hand-operated screw to run the saddle, turn very slowly. If no leadscrew at all, only an ordinary slide-rest, the top-slide must be set to turn parallel before boring; and I've already described umpteen times, how this is easily done.

The portfaces can be machined up with the casting either held by the ends and sides in the four-jaw, or mounted on an angle-plate, end-up, with a bolt through the bore. In either case, protect the already-machined surfaces with a bit of soft metal between them and the chuck-jaws. Set the portface so that it will finish square with the bolting flanges. The latter can be machined off with an end-mill in the three-jaw, in a manner somewhat similar to the method I have frequently described for axleboxes. If a vertical-slide is available, bolt the machine-vice to it, and hold the casting in it, with the portface at right-angles to the lathe bed. This can be set in two wags of a dog's tail, by putting on the faceplate, running the casting up to it, holding the portface against the faceplate, and tightening the vice-jaws on to the casting whilst holding it in that position. The endmill or slot drill should be about $\frac{3}{8}$ in. diameter. Adjust the vertical-slide to bring the endmill level with flange; feed into cut with top-slide, and traverse across with the cross-slide. To machine the second flange, simply adjust height of slide to suit, and ditto repeato operation. Anybody who is lucky enough to possess a vertical milling machine can emulate Curly. I just grip the casting, portface up, in the machine-vice, put an endmill about $\frac{3}{8}$ in. diameter in the collet, and not only take out the two flanges and the edges of the portface with one cut apiece, but chaw off the surface of the whole blessed portface at the same setting. Then the three surfaces can't help being true with each other.

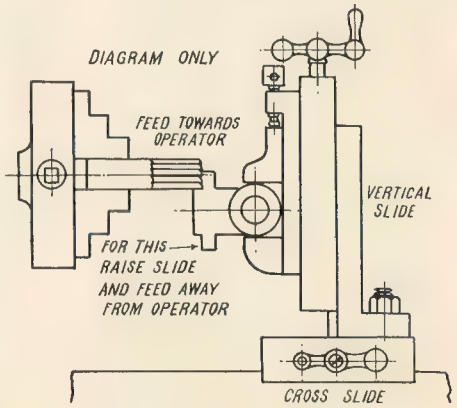
If no machining facilities are available, call in the aid of the humble but very useful file. It takes longer; but with the average amount of gumption, and a little patience, you get there all the same!

Ports and Passages

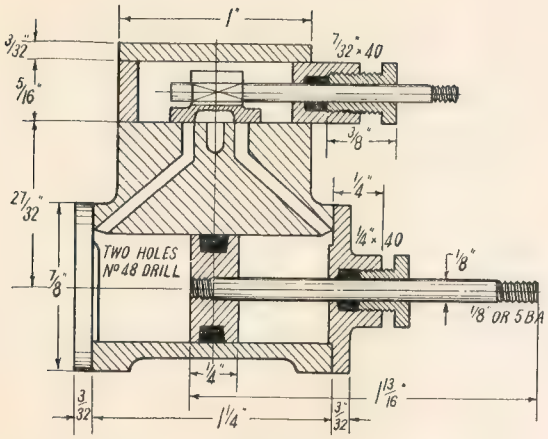
Mark off the ports as shown. May I remind beginners that if they dissolve some bits of shellac in methylated spirit, and colour the solution with blue or violet aniline dye, it will dry in a matter of seconds when painted over the surface to be marked. The scriber scratches will show up like the railheads at Clapham Junction on a sunshiny day. It isn't worth while setting up the baby quin's cylinders to mill the ports, and a doubtful refinement on the "next size larger." If three No. 55 holes are drilled very close together in the marked-out area of the weeny steam port, and one No. 43 in the exhaust ditto, they can easily be chipped to shape by aid of a little chisel filed up from a bit of 3/32-in. silver-steel. Temper to purple; if tiny chisels are too hard, the edge chips. The holes can be drilled fairly deep, but the chipping need only go down about $\frac{1}{8}$ in. Drill three No. 53 holes for the larger size steam ports, and two No. 43 for the exhaust, chipping them rectangular as mentioned above.

I don't like the long passages between ports and bore; but with this type of cylinder, it is unavoidable. To minimise the waste of steam, the passages should be only large enough to pass freely the amount of steam necessary to maintain speed and power with a normal load; and the sizes shown will just do this. File a bevel at the lip of the bore, and make two centre-pops on it. Set the casting in a machine-vice on the drilling-machine table, on the slant, so that the drill will aim straight at the bottom of the port; this can be sighted with the drill outside the casting. Use a drill ground just a wee bit off centre, so that it cuts a bigger hole than its own diameter. Drill not more than $\frac{1}{8}$ in. at a "bite," withdrawing the drill to clear the chips; and by that means, the drill will safely reach the port. Be careful how you feed when the drill is breaking through, or there will be another break; and don't overshoot the platform, and pierce the exhaust port, or you've had it!

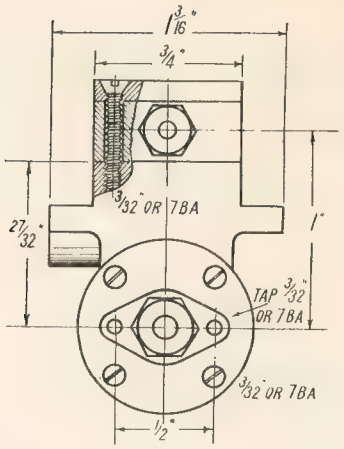
If no machine is available, put the drill in the hand-brace, and set the



How to mill cylinder bolting flanges

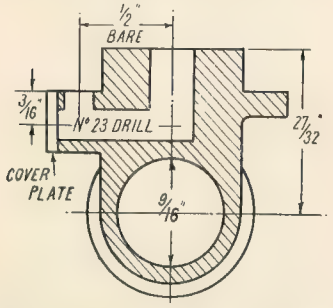


Section of gauge " 1 " cylinder

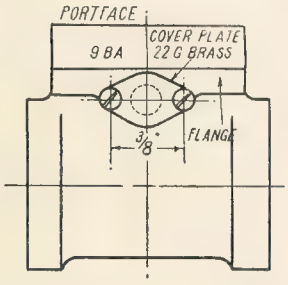


Back end of gauge " 1 " cylinder

cylinder in the bench vice at such an angle that if the brace is held horizontally, the drill will hit the port. Take it steady, keep withdrawing to clear chippings, and success will attend your efforts.



Section through exhaust port—gauge " 1 " cylinder



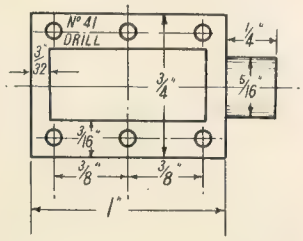
Plan of gauge " 1 " cylinder

Smooth off the top of the exhaust boss on the casting with a file ; centrepop it, and drill down with the size shown, into the exhaust port. Then drill the corresponding hole in the flange; this isn't tapped, as I am arranging for a breeches-type exhaust pipe, to simplify erection and give a free exhaust. As the hole in the boss is too shallow for a screwed plug, it is covered by a little oval flange cut from sheet brass or copper, and attached by two screws as shown. As it never has to come off again, you can solder it as well, to ensure steamtightness, if you so desire.

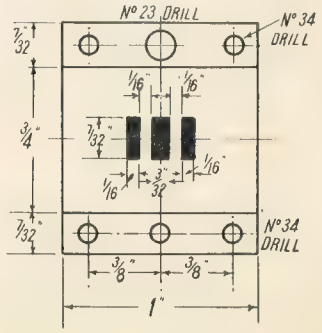
Covers, Glands and Steam-chest

The front cover of each cylinder is just a plain turning job, held in the three-jaw by the spigot provided. The register that fits the bore, need not be a tight fit, but shouldn't shake. The chucking-piece can be either sawn or parted off, the cover being held either by the edge in the three-jaw, or in a simple step-chuck such as I described in the *Tich* serial, for turning the outside. The contact side of the back cover flange, and the register, are turned same way, but the latter should be an exact fit. Before removing from the chuck, centre the cover, and drill the hole for piston-rod, No. 41 for the smaller, and 30 for the larger. Rechuck the other way around, cut off chucking piece, face oval boss, and open out and tap for the gland, to sizes shown. The glands are made from hexagon rod held in the three-jaw, and need no detailing. They should be reamed to suit the piston and valve rods. Each cover is attached to cylinder by four screws as shown.

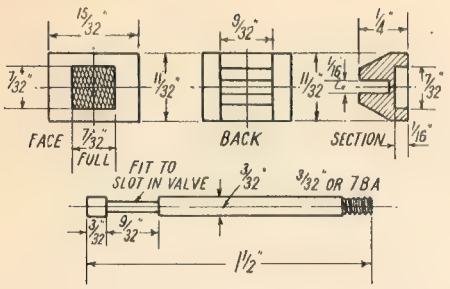
To ensure that the guide bar holes are correctly located, attach back cover temporarily; lay cylinder, port-face down, on the lathe bed, with a scribing-block beside it, setting the needle to the centre of the gland hole. I usually put a dummy gland in, with the centre marked on it. Scribe a line along the gland boss, taking care that the base of the scribing-block doesn't lift. Set out the holes on this line, at the distances shown, centre-pop the marks, and drill the tapping holes either on a drilling-machine, or in the lathe, without



Steamchest—gauge " 1 " cylinder



Portface—gauge " 1 " cylinder



Slide valve and spindle-gauge " 1 " cylinder

removing the cover from the cylinder. Start the tap truly by aid of the drilling machine or lathe chuck, finishing the tapping by hand.

Piston-rods

These can be made from ground or drawn rustless-steel or phosphor-bronze screwed at each end as shown. Rough-turn the pistons to about 1/64 in. over finish size, from rod held in chuck, centring and drilling tapping size before parting off. Chuck each separately, open out half thickness to drive fit for piston-rod, and tap the rest to suit rod. Hold rod in tailstock chuck, run rod up to piston, enter rod, and pull belt by hand until the rod is drawn home. Face off any projection. Finish-turn piston to exact sliding fit in bore, with rod held either in a collet, or a split bush in three-jaw.

The steam-chest can be faced on both sides by chucking in the four-jaw It can also be chucked in the four-jaw, with the boss running truly, for turning, facing, drilling and tapping same, in the same way as back cover. Fit the same type of gland, made from hexagon rod. The steam-chest cover is simply a piece of brass plate, of the thickness shown, same size as steam-chest. Set out the screwholes on it, as shown on the steam-chest, drill them and then use the cover as a jig for drilling the holes in steam chest walls. If the chest is then temporarily clamped to the portface,the drill can be run down it, and countersinks made on the portface. These are opened up and tapped to take the steam-chest fixing screws, as shown.

Slide-valves and Spindles

All dimensions of the slide-valves and spindles are shown for both sizes. The latter may be rustless steel or bronze. The valves may be castings, or sawn and filed from bar material. The cavity can be formed either by endmilling with a dental burr, or by drilling countersinks in the previously marked-out space, and chipping with a home-made chisel, to a rectangular shape. The best way to form the slots in the back of the valve, is to hold same in a machine-vice (regular, or improvised from bits of angle and bolts) on the saddle or cross-slide, and traverse under a saw-type milling-cutter of correct thickness, on a stub mandrel held in the chuck or an arbor between centres; the valve can be set at a height sufficient to take out the full depth at one cut. Otherwise, make a rough slot with a hacksaw, and finish with a watchmakers' flat file. The flat on the valve spindle should fit easily in the slot, but there must be no appreciable endplay; *very* important that !

Before assembling, drill the holes shown in the cylinder bolting flanges, smooth off all burring, and rub the portfaces and valves on a piece of fine emerycloth laid on the lathe bed or something equally flat. Put washers of oiled brown paper, or 1/64 in. Hallite or similar jointing, between all the contact surfaces, and pack the glands with a few strands of graphited yarn. Next, the larger cylinders, which will be slightly different in detail, from those described above.

That Tiresome Fur

By John F. Bruton

DURING the construction of a live steam locomotive there are many great moments: the completion of a bogie, the valve-gear parts all made, the coupling-rods beautifully fitted to the spinning drivers, are all mildly exciting events. Equally, there are hours of near drudgery making bolts and studs, heavy filing of frames, tedious bits and pieces for boiler fittings. During all this time, notes appear in the model engineering press of various people's excellent locomotives, all of which have one thing in common. Steam can be raised from cold in something around ten minutes, often much less. You press on determined to finish the job and hoping that your boiler, too, will be a lightning steamer.

One day all is ready, the fire is lit and, lo and behold, a good head of steam is raised in a very short time. This is the stuff to show the lads, but as time goes on it takes longer and longer to get something on the clock. There can be only one reason; the boiler is getting furred up, much of the heat from the fire is lost.

Care must be taken in any attempt to remove this troublesome material. The boiler, being made of a number of metals with soldered and brazed joints, might easily be damaged by using hydrochloric acid (spirits of salts) to dissolve the fur. A preferred perfectly safe method is to use Calgon, a water softener made by Messrs. Albright & Wilson Ltd. It can be bought from any good ironmongers in 2, 7, and 28 lb. tins.

Calgon is a form of pure glassy sodium metaphosphate which can be readily dissolved in water. Its primary function is to prevent the formation of scale, rather than to remove it.

In treating a boiler, a 10 per cent. solution should be prepared by dissolving a quarter of a pound of the powder in a pint of water. In order to preserve the full properties of the material, it is preferable to use clean rain water. The solution should then be poured into the boiler and a gas burner put into the firebox. If the solution is allowed to simmer at atmospheric pressure for about six hours, the fur will be loosened and will run out through the drain plug in the form of very fine mud.

It might be necessary to carry out the treatment more than once, but two boilings seemed entirely to clean the boiler of a 5 in. gauge engine.

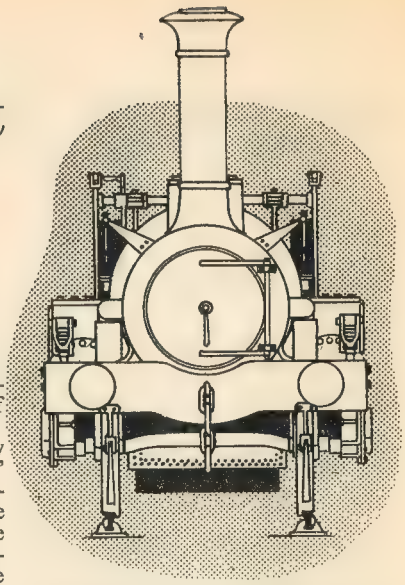
Two words of warning. Calgon is hygroscopic, that is it absorbs moisture from the atmosphere. The lid must be kept on the tin. Secondly, it has a host of uses in the household, so it is as well to make sure of enough for the boiler before the good lady of the house gets hold of it and appreciates its good points; wash-days, washing-up, cleaning of floors and paint, all being made easier. And a heaped tablespoonful in the bath makes it quite luxurious and fit for model engineers to wash in.

Crampton Retrospect

By

J. C. Cosgrave,

A.I.Loco.E.



NOT model engineers only, but all who are interested in locomotive history, have reason to be grateful to Mr. Twining and to THE MODEL ENGINEER for the admirable series of articles dealing with "British Crampton Locomotives" which fill a lacuna in a subject that has been strangely neglected. His masterly drawings depict several machines of which either none, or hopelessly inadequate ones have hitherto been published, and by careful and scholarly criticism he has rectified errors that had even crept into the classic works of Tredgold and Clark. It were superfluous to praise the perfection of the drawings; the remarks on this head in the prefatory note to Part 1 are abundantly justified, and show a unity of technical accuracy with artistic achievement that is, alas, almost extinct today.

I have reason to know that there are many who would have liked to model a "Crampton," but have been frustrated in this laudable ambition through lack of adequate information, and to such Mr. Twining has now supplied the answer. It was a happy thought to give the valve-gear details, necessarily obscure in the general drawings, and the particulars of the painting, etc., should also be most helpful.

His incidental observations are illuminating. For instance, the point about the flangeless third pair of carrying wheels and the alleged "track spreading" by the *Liverpool* has never hitherto been noted, even by so well-informed a writer as the late Mr. Ahrons.

On the whole, British historians have failed to do justice to Crampton, in contrast to Continental authorities, perhaps because for a variety of reasons his locomotives were never given a chance to demonstrate fully their merits in this country; and also, it may be, to the fact that Crampton never held an official position on our railways. I am, besides, inclined to think that one of the best features of his design—the visible and accessible mechanism—was abhorrent to nineteenth-century British locomotive engineers; an inexplicable prejudice that long persisted here and has indeed been overcome only in very recent times. On the other hand, quite the contrary was the case abroad, and it might well be claimed that his ideas did much to influence Continental designers to adopt external valve-gear in the interest of simplicity.

Crampton's insistence on a low centre of gravity and "outsize" driving wheels for high-speed locomotives has been derided in the light of experience that a high centre of gravity does not seriously compromise stability; but it should be remembered that in his day derailments were far from uncommon, due to imperfect track, and with a low c.g. the disastrous consequences of such mishaps were greatly minimised, as the engine had a better chance of remaining upright and rolling forward harmlessly and so avoiding the destruction of the following train of vehicles by piling up. The large driving wheels entailed moderate piston velocity, and this again was a valuable feature in times when lubrication was primitive and the balancing of reciprocating moments imperfectly understood. It is worth remarking that the French engines were better provided for in this latter respect, and they also usually employed cylindrical boiler barrels, the departure from which form in many British examples is the only feature of Crampton's designs open to grave objection.

The pre-eminent speed capabilities of the "Crampton" system were fully exploited in France. As early as 1853 the "Crampton" engines on the C. de f. du Nord were officially permitted a speed of 120 km./hr. and in 1855 the Emperor Napoleon III was brought from Marseilles to Paris at an average speed of 100 km./hr. by locomotives of this type, a performance that was repeated in 1869 by the imperial train conveying the Empress Eugénie on her return from the festivities in connection with the inauguration of the Suez Canal. The highest authentically recorded speed is probably 144 km./hr. which was attained by a "Crampton" belonging to the C. de f. de l'Est, between Montereau and Sens during some special speed trials on the P.L.M. This engine was of the normal type, save that it had been provided with a "Flaman" double-barrelled boiler, and it easily surpassed all the other machines under test.

It may be of interest to mention that the "Crampton" engines, in France at any rate, were remarkably economical in fuel, maintenance, and first-cost. A standard 2-2-2-0 delivered to the Northern Railway by Derosne & Cail, in 1849, which could develop 400 h.p., cost only 58,000 frs. or 2.35 frs. per kg. The immense popularity of the Crampton engines in France is, therefore, not surprising, an esteem accorded by the public at large, amongst whom the saying "prener le Crampton" meant "to take the express train."

Outside France, Belgium and Germany but a few engines were built to this system, the only other European countries to have specimens (so far as I know) being Denmark and Russia, which last had at least one example, according to a photograph in my possession.

Although I share Mr. Twining's opinion as to the inside-cylinder Cramptons, I feel a little regret that they could not be included in his conspectus, and a reference to the curious experimental locomotive *La Blache* would, I doubt not, have been welcome; for, despite the fact that their success was far from that of his orthodox engines, their inclusion would have completed the story of one of the most original and inventive locomotive engineers.

In conclusion, may a hope be expressed that Mr. Twining's most valuable and important contribution to the history of the locomotive may sometime appear in book form? Such a work would undoubtedly make a wide appeal to many readers both here and abroad.

READERS' LETTERS

PORTABLE ENGINES

DEAR SIR,—The photograph on the cover of the February 18th issue brings back to me memories of my enforced stay in a working camp for British P.O.W.s in Germany.

This camp was built in the middle of a forest, and we were employed in a sawmill. During the working day the plant was driven by a Wolfe 176 h.p. industrial "steamer," but in the evenings, and on Sundays a small Marshall portable was used to generate electricity and pump water, etc.

This engine was cemented in to the floor of the building which housed it, and drove a 450 V three-phase dynamo. The interesting point is that it was fired entirely on wood logs which were cut (whilst the engine was running) by an electric saw run from the generator. As far as I can see from the photograph, the only difference in the two engines is that "ours" had a governor driven by a flat belt from the crankshaft.

The privilege of "driving" the engine was between three of us, officially two of us were designated "engineers," and the third was "fireman." An old Russian at the camp used to saw the wood and place it handy for the "fireman." As this machine was responsible for the comforts of the camp (light, water, etc.) I need hardly tell you that it never "went wrong," whereas the "Wolfe" which was responsible for work, used to develop some peculiar habits (including, quite frequently, loss of steam). In fact, I could write pages on the subject, which was, for us, a matter of amusement which the Germans did not share!

Yours faithfully,
Kings Lyn. GEO. W. A. CHAPMAN.

A STEAM-DRIVEN MODEL CAR

DEAR SIR,—The sight of the water-tube boiler behind the seat at once reminded me that I had seen this layout before, so I went to my bookcase, picked out the first volume of THE MODEL ENGINEER that came to hand, opened the index, and there it was!

During April and May, 1917, a design for a model steam car appeared under the authorship of R. Koechlin, and a glance at the drawings confirms that Mr. Blomquist's car was undoubtedly built to this design. There are detail differences such as the fitting of a displacement lubricator which is not shown on the original drawings, the placing of the track-rod in front of the axle instead of behind, and the fitting of dummy plugs instead of compression taps, but in all major respects the design is followed accurately.

It is interesting to note that Mr. Koechlin states that he has not built the car, but the obvious success of Mr. Blomquist's model shows that there was very little wrong with the design, which appears to be complete in minute detail.

The engine is not described in the 1917 article, but the author refers to an article published in February 1914 which dealt with this.

Whilst appreciating the difficulties involved, I feel that it is a pity that tyres so out of harmony with the rest of the car should have been fitted. In this connection, the designer says, "if some of the rings placed on dumb-bells to avoid noise are found to be the right size, they should be used. If not, make the tyres out of solid round rubber, the ends being cemented together."

The designer discusses, at the end of his article, the possibility of leaving out and simplifying certain details, but Mr. Blomquist appears to have worked to the design in its entirety.

Yours faithfully,
North Wembley. S. H. RUTHERFORD.

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the iews expressed by correspondents.

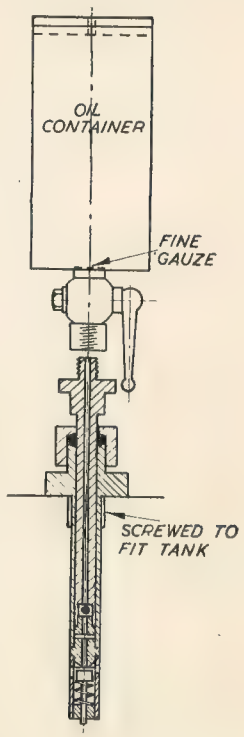
A FUEL PUMP

DEAR SIR,—I have recently converted my 2½-in. gauge 5XP to oil fuel, as it has never steamed satisfactorily when using coal. The paraffin oil burner certainly provides adequate steam, but not for long enough periods. After about fifteen minutes or so, the tank runs dry and that is the end for the time being. If another run was desired, the tender had to be uncoupled, the tank filled and the lamp restarted and coupled up.

The following device overcomes this difficulty. I don't know whether the idea is new or not. It seems so obvious that somebody must have tried it some time or other. Anyway, this is it, for what it is worth: First, a gauge glass was fitted to the tank, so that the oil level could be seen. Then a new pump was made with a hole running through the whole length of the ram, which is only ¼ in. diameter; I thought it would make the pumping action easier, although it would require more strokes. There is no packing at the bottom of the ram, as it was thought advisable to keep it away from the paraffin as much as possible. The packing is contained in a gland at the top of the pump.

The top end of the ram is screwed to take a container filled with oil which can be pumped into the tank. The container is then taken off and the pump used to pump air when necessary.

The container is fitted with a tap at the connection end and a plug with an air vent at the other. It can, therefore, be filled with oil while disconnected. When it is screwed on to the pump the tap is turned on and the oil pumped



into the tank, thus avoiding the risk of spilled oil becoming ignited by the burner flame.

The pump maintains an adequate pressure without an undue amount of pumping, in spite of the small diameter.

The sketch shows the pump and container,

Yours faithfully,
Newcastle, Staffs. ALFRED CAPPER.

LATHES FOR THE BEGINNER

DEAR SIR,—With reference to "Cadet's" article in the April 22nd issue, I am sorry to learn that he has had difficulty in obtaining sound advice on the selection of a lathe, and even more so to find that on reading the "M.E." Lathe Manual, he has formed the impression that I advise obtaining *two* lathes to begin with! My advice to the beginner, that he should preferably obtain experience on a simple and inexpensive type of lathe, does not imply that such a lathe will be inadequate for serious model engineering, either initially or at a later stage when more experience has been gained. Many model engineers who produce work of the highest class are using lathes of the most modest type, which were purchased anything up to half a century ago. One can do good work on the simplest and most primitive lathes—as witness the fine workmanship produced by early craftsmen; but it takes more time and pains than on a modern luxury lathe with all the latest refinements; for this reason, the former is really better suited to the training of a raw beginner.

Neither should it be assumed that the said raw beginner need necessarily "bend" the lathe in the course of his training, as suggested by "Cadet"; the fact is that one can take greater liberties with the simple lathe—and get away with it—than one would dare to do with an expensive one. The most expensive commodity in a machine tool is *guaranteed accuracy*, and it is also the most destructible; an inexperienced user is far more likely to do irreparable harm to such a machine than to one of simple type. And provided that one does not do completely "daft" things to a lathe, such as using the bed for an anvil, or the mandrel for a heavy bending machine, it is always a negotiable commodity, if and when the time comes, and funds are available, for the purchase of a more advanced type of machine.

Further, "Cadet" and other beginners may be consoled by the thought that few model engineers ever begin with the neatly planned, "ideal" workshops that so many dream about. Speaking for myself, and many others of the fraternity that I know, the average model workshop is evolved either on the "Eric" plan—"little by little"—or "Topsy"—"just growed!" Many beginners do not seem to think it possible to start model engineering until they have everything "laid on," but I have often expressed the opinion that the person who waits for this to happen has not got the stuff that model engineers are made of. I have seen good models made in boot cupboards, coal cellars and rabbit hutches, on lathes improvised from breast drills, sewing machines and bicycle parts. It is my firm opinion that this constant challenge to ingenuity and resource in tackling problems with inadequate tools and facilities, is one of the most important factors in model engineering success.

Like every other model engineer, I have the keenest appreciation of the advantages of good tools, and always use the best tools I can afford. But it's the man behind 'em that counts far more than the quality of the tools he employs!

Yours faithfully,
Carshalton. EDGAR T. WESTBURY.

STEEL BOILERS

DEAR SIR,—Model engineers contemplating building a boiler in steel with non-ferrous tubes, will no doubt be somewhat shaken by Mr. J. H. Daltry's remarks re corrosion, particularly in view of his academic qualifications.

But let us examine these remarks from a model engineer's point of view. It is, I believe, a fact that any dissimilar metals immersed in an acid or alkaline solution will create a cell; and that an electric current will be created, and bring about the eventual breakdown of at least one of the metals. Also, the use of impure feed water in, for instance, modern power station work, where boiler pressures and temperatures are many times greater than our own steam raisers, can create many problems for the boiler engineer. But I have found that in practice, so far as small loco-type boilers are concerned, this corrosion factor is not so great as to be of any serious consequence; the ordinary kind of rust is more likely to cause serious damage, and mainly through neglect when a boiler is not in use.

I lived for many years in a district where the water was of an acid value, and among others, a steel boiler from a 1½ in. scale traction engine came to me for re-tubing; a certain amount of pitting had taken place in the tube holes in the firebox tube-plate, but after the holes were reamed 0.020 in. larger, this was rectified, very slight pitting was noticed around the water side of the plate, but this was proved to be very little after a series of drill tests. It was found that this particular boiler had been in *intermittent* use for *twelve years*. This was not an isolated case.

If any model engineer wishes to build in steel, either from a cash consideration or for a desire to try a steel boiler, go ahead, and with brass or copper tubes.

The plate thicknesses and tube gauges should conform to the information given in "Queries and Replies," April 1st issue.

Yours faithfully,
Littlehampton. JOHN H. MEAD.

MICROSCOPE LAMP

DEAR SIR,—I was interested in the article in the April 1st issue, by Mr. L. H. Sparey. Having a microscope already, the special lamp appealed to me. I am hoping that the writer will in due course, describe this in detail. If not, perhaps he would give particulars of the optical parts, the make and rating, etc. of the bulb used.

Regarding the latter, I was informed by a professional microscopist that a car-type bulb gave poor results.

Yours faithfully,
London, S.W.9. W. KEYBRAK.

IGNITION PHENOMENA

DEAR SIR,—I have followed with much interest the correspondence in your columns relating to ignition troubles experienced by Mr. R. H. R. Curwen. The theories given by correspondents have been interesting, but I note from Mr. Curwen's latest letter that this has failed to supply the answer.

I should like to suggest a practical solution, and one which I have used successfully with full-size engines showing similar trouble. Fit softer plugs, i.e. plugs which run at a higher temperature; such plugs will burn off the excess oil and not be short-circuited by it. The plugs which Mr. Curwen is using are probably the type suitable for the small high-speed racing engines in common use and are consequently unsuitable for this slower and cooler-running engine.

I suggest that Mr. Curwen contacts the plug manufacturers on this point.

Yours faithfully,
Newtownbutler. I. WILSON.

[*While the advice given by Mr. Wilson may be sound, the difficulty is that the choice of plugs for these small engines is extremely limitea. Generally speaking, however, most of the plugs available are on the "soft" side, because of the excessive oiliness of most of the small engines for which they are primarily designed. Up to the present, plug manufacturers have not shown much interest in the problems of amateur experimenters, or willingness to co-operate with them.* —ED., "M.E."].

Model Power Boat News

BY MERIDIAN

MORE AMERICAN BOATS

HERE are some further photographs supplied by Bob Graham, and two of these illustrate the steam-driven boat built by Michael Succarde of the New York M.P.B.C.

The details of this ingenious craft are of much interest to steam enthusiasts, and should provide some food for thought.

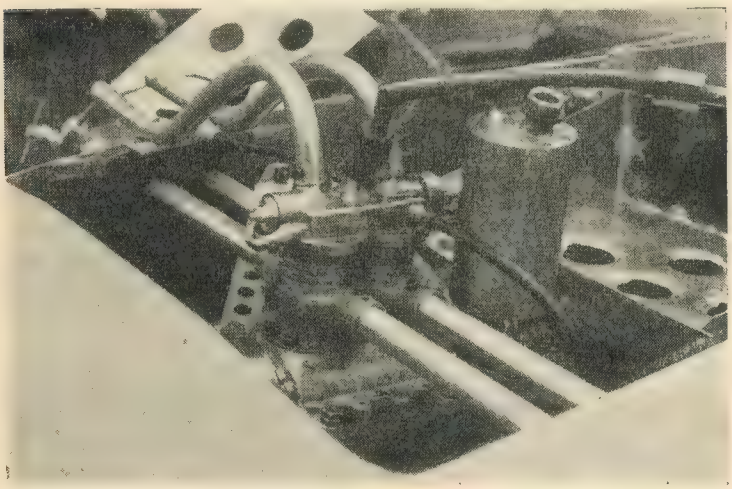
The first point to be noted is that the usual flash-boiler arrangement has been discarded in favour of a type of semi-flash boiler. All the water required is carried in the boiler drum, and thus there is no engine-driven feed pump.

The drum of the boiler is made of chrome-molybdenum steel. It is laid on its side within the boiler casing, positioned so that the centrifugal effect of the circular course banks the water to the side fitted with water-tubes. These water-tubes are arranged longitudinally, and in addition, there is a long length of steel superheater tubing coiled in several banks. The total length of tube appears to be about the same as that used in most flash-steamers of conventional type.

The Class " A " boat by Mike Succarde, of Detroit, fitted with twin uniflow engine and semi-flash boiler

A triple-burner blowlamp provides the heat, and has a normal pressurised fuel container. This fuel tank can be seen in one of the photographs, positioned on the side of the boat.

The twin-cylinder engine has a bore and stroke of one inch, so the total cylinder capacity is greater than in most flash plants used in model boats. Piston valve is $\frac{1}{2}$ in. diameter, and is driven from the main shaft *via* bevel gears and a small crank. The connecting-rod driving the valve can just be seen in the " close-up " of the engine, but most of the valve-gear is obscured by the oil container.



The steam engine of Mike Succarde's Class " A " boat, showing arrangement of water-cooled piston valve, and displacement lubricator

An Interesting Feature

This is the water-cooled valve-chest, which is fed by means of a simple scoop collecting water while the boat is travelling; after cooling the chest, the water is ejected overboard. Two rubber tubes carrying this water can be seen attached to the chest on either side.

The cylinders have shallow fins, and below these, a split manifold is fitted to carry away steam from the exhaust ports in the cylinder walls. Exhaust events are also controlled by the valve, and thus there are six exhaust pipes to carry the steam clear of the hull.

Instead of the monobloc arrangement of cylinders usually employed on twin S.A. engines, the cylinders are made separately, and bolted to crankcase and valve-chest by means of Allen screws.

Lubrication of the internals is provided for by a type of displacement lubricator. Steam is admitted to the bottom of the oil container, and oil enters the main steam line from another pipe at a higher level. There appears to be no needle valve control, so the amount of oil delivered to the engine is governed by the size of the inlet and exit pipes.

The working pressure of the plant is around 600 lb. per sq. in., which is very high, and must approach the pressures attained in some flash boilers.

Mr. R. Palmer, of the Chicago Model Power Boat Club, with his Class " D " (10 c.c.) boat which holds the world record for its class at 78.94 m.p.h.

No Driven Pumps

From this description of the principal features, it can be seen that the engine does not have to drive pumps of any kind, and thus the full power output is available at the propeller. The latter is 3½ in. diameter by 8 in. pitch, and is of normal two-bladed pattern. To achieve the record speed of 68+ m.p.h., and allowing 30 per cent. slip, calculation shows that engine revs. are in the region of 13,000. Actually, not much is known about the slip percentage of surface props., but I have reason to believe that the figure may be higher than is generally estimated by most speed boat men.

To flash steam enthusiasts, the high performance attained by this boat will inevitably raise the query " are water pumps taking too much power to drive ? " and it is a fact that the successful flash steamers all seem to perform at their best when driving huge props., indicating fairly low r.p.m.

Reduction gearing to the pump is usually in the 4 : 1 range, but in the case of Mr. Pillinor's boat the ratio is less than 3 : 1. It is possible that the pump has a limiting effect on the maximum engine speed, since besides taking more power to drive, the pumping efficiency tends to fall away as the number of strokes per minute is increased.

Geared Propeller

There seems to be quite a good case for gearing up the propeller, since, unlike i.c. engines, ultimate power is not tied up so much with r.p.m. The steam engine is very flexible, and lower revs. would probably result in higher boiler pressure, which should make for more efficient working. The use of smaller propellers, too, would help the stability problems of the hull.

The experiment might be well worth while, but flash steamers are already such time-consuming animals that I can well imagine constructors jibbing at the prospect of further trouble in the shape of gearboxes !

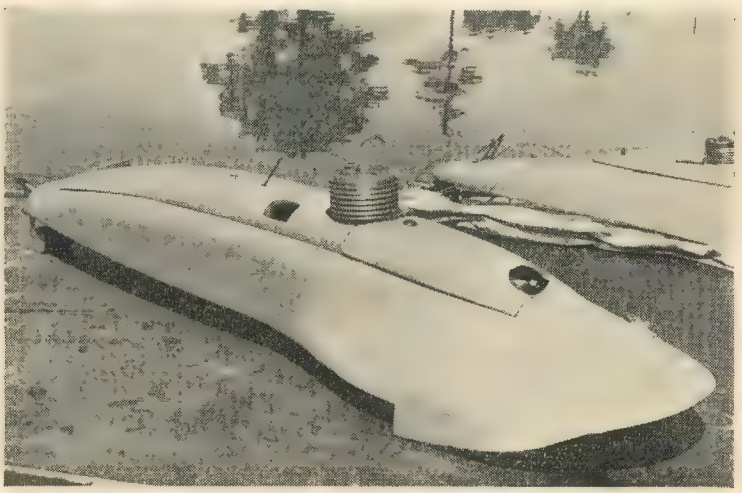
Streamlining

The other photographs reproduced here are good illustrations of the streamlining trend in American model hydroplane design.

One of these shows Robert Palmer with his Class " D " boat, which has attained 78.94 m.p.h. The engine is home-built, and the hull appears to be similar to the one described a couple of years ago in an article in *Model Ships and Power Boats*.

The Class " B " (30 c.c.) record-holder built by Charles Watkins is also very interesting. The length overall is 36 in. and beam is 10 in. As can be seen, the streamline effect is very pleasing, and probably helps to gain several m.p.h. when speeds around the 80 mark are considered. The engine of this craft was illustrated in the previous article on activities in the U.S.A.

Once again I would like to express thanks to Bob Graham for sending us the photographs and " gen," and I am sure that all power boat enthusiasts will join with me in sending fraternal greetings to our colleagues across the " big pond." Needless to say, if any of them are able to spend a holiday over here, they will be heartily welcomed, especially if they bring a boat with them !

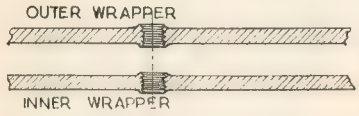


A Class " B " (30 c.c.) boat, built by Mr. C. Watkins of the Chicago Model Power Boat club, holder of the world's record at 81.81 m.p.h.

Staying a Boiler

By E. R. Uphill

MY first attempt at boiler staying proved a successful failure. The boiler was for a 3½ in. gauge *Juliet*, and instead of ⅛ in. stays, it finished with an assortment ranging from ⅛ in. to ⅜ in. which were only rendered tight by the use of soft "tommy." My second attempt was a 3½ in. gauge *Princess Marina*, which finished with a full complement



Sketch showing the raised rim left by the tap

of ⅛ in. stays, again rendered tight by the use of soft "tommy." Having got this boiler tight, I resolved that on any future boiler I would not retire down the garden shed armed with one blowlamp, one pricker, one gallon of paraffin, ½ gallon of Baker's fluid, six sticks of solder and an assortment of wire brushes, only to emerge some two hours later with a boiler that may or may not be tight, watering eyes, a sore throat, ½ gallon of Baker's slowly dripping through the floor and a pair of overalls delightfully spotted with the remains of the solder !

My third boiler, for a 5 in. gauge 0-6-0 L.M.S. tank loco, was completed with all stays tight, without the use of soft solder. With hydraulic pressure of 300 lb. in the boiler and a garden rake in one hand I looked inside the firebox expecting to harvest a grand crop of leaks ; but to my amazement it was perfectly dry. I pondered over this amazing phenomenon, and eventually put it down to sheer luck.

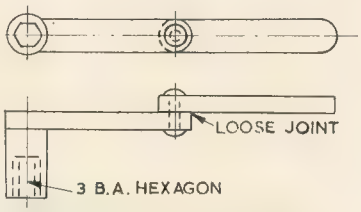
I decided to try to repeat this performance on my new boiler for a 5 in. gauge 2-6-2 Ivatt tank loco, and instead of firebox girders, to use twenty $\frac{3}{16}$ in. stays. There are 76 side stays, four throat plate, six backhead, two long stays and six cross stays. When all stays are in there are 184 chances of a leak !

Two $\frac{3}{16}$ in. × 40 taps were required with ⅝ in., and 2 in. of pilot, these were screwcut on the lathe.

Three flutes were filed in with a three-square needle file, After hardening and tempering and letting the pilot down to a blue colour, they were tested on odd scraps of copper sheet ; they did not cut like a commercial tap, but part cut and part rolled a thread, leaving the rim of the tapped hole raised about 1/64 in. This state semed just right for the nuts to bed down on.

Making Stays

All the stays were made from $\frac{3}{16}$ in. hard copper rod. The die was adjusted until the stay could be screwed home only by the aid of a tap wrench. A 12 in. length of rod was screwed for $\frac{13}{16}$ in. with a good supply of cutting oil, and each thread was carefully examined with a watchmaker's eye-glass, and any torn threads were rejected. The stay and tapped holes were then



An "L.B.S.C." box spanner

liberally coated with plumbers' jointing and, with the aid of a tap wrench, they were screwed home. With a minimum of eight inches of rod, the wrench is carefully turned until it will twist about a quarter turn and then spring back. Extreme care must be taken with a shorter length of rod or the stay may be forced right through the wrapper sheet. About ¼ in. of stay is left sticking out of the side to provide a means of removal, if necessary.

Box Spanners

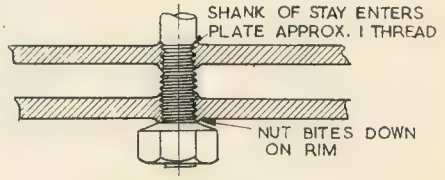
The next step was to make a 3 B.A. box spanner to "L.B.S.C." specifications ; this proved to be an excellent tool for the tedious job of screwing home the nuts which were tapped out $\frac{3}{16}$ in. × 40 and bevelled on the face. Each nut was then gripped in the vice, and, with the tap in a hand-brace, it was wound through the nut with a small circulating motion imparted to the brace to enlarge the hole, as the stays were about four thou. oversize.

When all the nuts were down tight, a close inspection was given to each stay and any doubtful ones were remedied.

Testing

The boiler was then rigged for hydraulic test, and pumping operations began. Eventually, the gauge began to register, and at 120 lb., two jets of water were seen, one from the front tubeplate and one from the barrel seam. The tube was sealed with a taper drift and the pin-hole in the seam was peened over with a small hammer. At this critical moment in the test, the ringing of a bell announced the arrival of a cup of the engineman's best friend. Fifteen minutes later, when we returned to the boiler testing station, which was situated on the sink draining board, a quick look at the gauge revealed a drop in pressure of only five pounds. The firebox was inspected and passed, each nut had squeezed and spun the ridge down to a perfect steam-tight joint. Once again, down to the workshop and, with a good file, I removed the surplus stay ends inside and out. I now have a steam-tight boiler without having to resort to soft "tommy" or porridge.

Bevelled stay-nut, 3 B.A. brass, tapped $\frac{3}{16}$-in × 40



View of finished stay

WITH THE CLUBS

Topsham M.E.S.

At a recent meeting of the society it was decided in view of applications received from prospective members that our premises would have to be enlarged.

Mr. Heywood, the owner and donor of our workshop, kindly consented to let us have more floor space to enable us to get more members, and work will begin in the next week of two.

Meanwhile our little band of followers continue to press on with the various jobs in hand, which include six locomotives, a couple of traction engines and, of course, the new club's locomotive *Anne of Holland*, to Rodgers and Geary design. It is going to be tried out with a steel boiler which is now practically completed.

Meetings are still held on Tuesday and Friday of each week at 7 p.m. and anyone interested is cordially invited to contact the hon. secretary, G. W. Bell, Pinehurst, Exton. Topsham, near Exeter.

Stockport and District S.M.E.

The society has a continuous multi-gauge locomotive track situated at Davenport, near Stockport. This accommodates all gauges from "O" to 5-in. A boat-testing tank is also installed on the same site. A programme of talks, works visits, etc., is being arranged for the coming season. A cordial invitation is extended to all model engineers in the district to join us at any of our meetings. These are held at The Foresters Hall, Churchgate, Stockport, on the first and third Fridays of each month, commencing at 7.30 p.m.

Hon. Secretary: D. Mapp, 163, Mauldeth Road, Withington, Manchester, 20.

Hitchin & District M.E.C.

At the annual general meeting the retiring officers were re-elected without change, and with the committee are planning both development of the club's "O" and "OO" layouts, together with, if possible, the completion this summer of the multigauge outdoor track.

Enthusiasts in all gauges are wanted and will be welcomed at the headquarters in Grove Road, Hitchin, any Thursday between 7.30 p.m. and 9.30 p.m.

Details of the club, proposed summer outings and track engagements will be supplied with pleasure by the club secretary, E. Keith, 25, Heathfield Road, Hitchin.

Salisbury & Dist. M.E.S.

Since the death, a few years ago, of Sir Walter Alcock, the society has had no president, but at a meeting recently, Mr. J. A. Scholefield was elected to the office.

For our exhibition, Whitsun, 1954, promised exhibits are: Mr. Tamplin's radio-controlled Churchill tank, which will be in operation; a radio-controlled car, model racing cars and model aircraft will also be demonstrated in the arena; a 1932 Foden tractor owned by Messrs. Howell & Barnett will be coming under its own steam from Andover; the local Short Wave Club will be operating radio transmitters and receivers, tape recorder, etc.; a vintage a.c motor car will be shown by Mr. H..J. Crabb; there will also be a bookstall, bargain stall, and stands by the R.A.F., Salisbury Technical College, Machine Tools (Letchworth) Ltd., (makers of flexible pressure pipes), and the trade. Mr. James Perrier has promised the very fine S.A.R. locomotive recently described in The Model Engineer, and there will be a highly secret working exhibit from Mr. G. D. Lovell, of which all we know at the moment is that it is a "smoke grinding machine."

Hon. Secretary: R. A. Read, 90, Woodside Road, Salisbury.

Tees-side S.M.E.E.

At a meeting held at Middlesbrough recently, the chairman of the society, Dr. W. H. Maclennan, spoke on "The Stephenson Valve Gear as Applied to Locomotives." He described in great detail the many technical points arising from the design and construction of such gear, the interdependence of many of the dimensions and the effect of the design on the performance and efficiency of the locomotives.

The talk was greatly appreciated by the many members and visitors present.

Hon. Secretary: J. W. Carter, 28, East Avenue, Billingham, Co. Durham.

Lincoln S.M.E.E.

At the a.g.m. held on April 14th, the society's financial status proved sound.

The election of officers resulted in Mr. D. Gale, president; vice-president, Mr. Pollard; Mr. Pratley, treasurer. A new office was created, viz.: public relations officer, Mr. Geo. T. Gindall.

On the whole we have had a successful year, seeing the opening in January of the "Grand Prix" car track, and the first run of the society's new loco, a 5 in. "Minx." We hope to publish a list of vacant dates on the locomotive track for the use of other societies and lone hands who would like to test their engines on a continuous track of 460 ft.

During the late autumn we became affiliated to the S.M.E.E. as members of the East Midlands Branch.

Through the help of our new president, we have been fortunate in securing some water for the use of our members whose interest is in boats and ships. The City Water Engineer, Mr. D. Whiteley, has placed at our disposal a settling tank at the old waterworks. This has been cleaned out and it is hoped to have it in use before Whitsun.

P.R.O.: Geo. T. Gindall, 53, Geneva Avenue, Lincoln.

Montreal Live Steamers Corporation

We held our seventh annual meeting on March 29th, in The Notre Dame de Grace Community Hall, and the meeting was attended by a little better than 50 per cent. of the membership. The directors elected were: Ralph Francis, Raymond Legare, Harry Turnbull, Wm. M. Massie, Wm. L. Leggett and A. W. "Bill" Leggett. At a directors' meeting immediately following the annual meeting, Raymond Legare was elected president and the vice-president is Ralph Francis. Cecil F. Harding was appointed secretary-treasurer for the seventh term.

We would again, through these columns, extend a very warm welcome to new Canadian live steamers from the United Kingdom, and we should be glad to hear from any lone wolf who lives in or around Montreal. They may contact the secretary/treasurer: Cecil F. Harding, 5850 Coolbrook Avenue, Montreal 29, Que., Canada.

Manchester S.M.E.E.

The annual general meeting was held recently at the Girls' Institute, Mill Street, Ancoats, Manchester. All retiring officers were re-elected.

Mr. F. Haynes, our treasurer, presented the balance-sheet which proved very favourable.

Our activities for the coming season include various trips in between the following track dates:

May 16th, June 13th, July 4th. Our track will accommodate 2½-in., 3½-in. and 5-in. gauge locomotives. Local clubs please note these dates for reference.

Hon. Secretary: H. H. Pentland, 71, Ridgway Street, Manchester, 14.

The Bristol Railway Circle

On Wednesday, May 19th, a visit will be made to the control room, Bristol (Temple Meads).

It is necessary to limit the number in the control room at any one time to six. It has, therefore, been decided to have two sessions, one at 7 p.m. and a second at 8 p.m.

All other Tuesdays and Saturdays are club nights.

Hon. Secretary: J. F. Burrell, 80, Longmead Avenue, Bristol, 7.

THE MODEL ENGINEER DIARY

May 15th and 16th.—Kodak Society of Experimental Engineers and Craftsmen. Exhibition at Kodak Hall, Headstone Drive, Wealdstone. Saturday, 2 to 9 p.m. Sunday, 3 to 9 p.m.

May 16th.—South London Model Engineering Society. Regatta for radio-controlled boats only, at Brockwell Park, London, S.E.

May 23rd.—Harrow and Wembley Society of Model Engineers. Launching of a 52-in. model tanker at the West Harrow Recreation Ground at 10.30 a.m.

May 23rd.—St. Albans and District Model Engineering Society and North London Society of Model Engineers. Regatta at Verulamium, St. Albans, Herts.

May 30th.—Forest Gate Model Power Boat and Engineering Society. Regatta for free running boats only, at Victoria Park, Hackney, E.9.

June 26th and 27th.—Birmingham Society of Model Engineers. National Loco Rally at Campbell Green.

July 10th and 11th.—International Radio Controlled Models Society. Annual Contests for radio controlled models, to be held in Birmingham.—Model Boats on July 10th, and Model Aircraft on July 11th.

August 18th, 19th, 20th, 21st, 23rd, 24th, 25th, 26th, 27th and 28th. The Model Engineer Exhibition, at the New Horticultural Hall, Greycoat Street, Westminster, S.W.1. Open from 11 a.m. to 9 p.m.

CONDITIONS OF SALE

This periodical is sold subject to the following conditions, namely, that it shall not, without the written permission of the publishers first given, be lent, resold, hired-out or otherwise disposed of by way of trad eexcept at the full retail price of 9d., and that it shall not be lent, resold, hired-out or otherwise disposed of in a mutliated condition or in any unauthorised cover by way of trade; or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

COPYRIGHT

All rights in this issue of The Model Engineer are strictly reserved. No part of the contents may be reproduced in any form without the permission of the publishers.

CORRESPONDENCE

The Managing Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Correspondence and manuscripts should not be addressed to individuals, but to the Managing Editor, The Model Engineer, 19-20, Noel Street, London, W.1.

SUBSCRIPTION RATE

The Annual Subscription is £2 2s. 0d. post free, to all parts of the world.

Private: 3d. per word. Trade: 6d. per word. Minimum 12 words. Use of box 1s. 0d. extra.

THE MODEL ENGINEER

Rates for displayed advertising in this section 35s. per single column inch 1⅞ inch wide.

CLASSIFIED ADVERTISEMENTS

The Advertisement Manager reserves the right to refuse or suspend advertisements without giving any reason. No definite date of insertion can be guaranteed. Every care is taken to avoid mistakes, but the publishers cannot be held liable in any way for printing errors or omissions. Receipt of "copy" for publication implies acceptance of these conditions by the advertiser. Whilst every care is taken to exclude advertisements from doubtful sources, no responsibility can be accepted by the publishers for the bona fides of advertisers.

WORKSHOP EQUIPMENT

Buck & Ryan for Lathes and Accessories, drilling machines, grinders, electric tools, surface plates, etc.—310-312, Euston Road, London, N.W.1. Phone: Euston 4661.

"Impetus" machines, wood planers, motorised drills, belt sanders, electric motors, paint sprays, air compressors, circular saws, etc. Catalogue.—JOHN STEEL, Castlefields, Bingley.

Whiston for Nuts, Bolts, etc., rivets 1/32″ dia. up, plastic belt, silver solder, silver steel, screwed rod, ballraces, etc. Send for 1,000 item list.—K. R. WHISTON, (Dept. M.E.S.), New Mills, Stockport.

Yes, Sir! Myford M.L.7 and "Zyto" lathes from stock! No waiting. Dispatched same day. Deferred terms arranged with pleasure. Write, phone or call.—Ross & ALEXANDER (LONDON) LTD., 165-7, Bishopsgate, London, E.C.1. Phone Bishopsgate 2220.

New (Slightly Soiled) 2½″-3-jaw (reversible) scroll chucks (model 32/Burnerd) reduced from £5 8s. to £3 10s. (1s. 9d. p. and p.). List supplied on request.—JOHN MORRIS (CLERKENWELL) LTD., 64, Clerkenwell Road, E.C.1.

Rebuilt Lathes. The Acorn Machine Tool Co. (1936) Ltd., offer rebuild to limits "Acorntools" and "Atlas" 10″ swing s.s. and s.c. lathes. Hire purchase terms are available. Write—610-614, Chiswick High Road, W.4. (Phone: CHI 3416).

Hand Shaping Machine for sale, 5″ Perfecto, as new, £8, free delivery 50 miles.—DRAPER, Orme Lodge, Titchfield Road, Fareham, Hants.

Immediate Delivery from Stock. Myford "M.L.7" and "Super 7" lathes, Grayson, Super Adept lathes, bench planer, shapers, electric motors, small tools.—F. W. KUBACH, 12, Sylvan Road, London, S.E.19. Lib. 3311/12.

"Acorntools" and "Acorntools" De Luxe 5″ s.s. and s.c. lathes, also "Acorntools" 7″ stroke high-speed shapers and ½″ capacity capstan lathes can be supplied *ex*-stock. Hire purchase terms available. Send for literature and full details to the manufacturers of these machines.—THE ACORN MACHINE TOOL CO. (1936) LTD., 610-614, Chiswick High Road, Chiswick, W.4. Tel.: 3416-7-8-9.

Britannia B.G.S.C. 4″ Lathe. Chip tray, makers' stand, 1/3 h.p. s.p. motor, chucks and accessories, £35.—MORSE, 8, Coles Lane, West Bromwich. Phone: Wednesbury 0978.

Wheel and Pinion Cutting, cutters involute, epicycloidal, etc.—A. A. OSBORNE & SON, 61, St. John Street, London, E.C.1. CLE 3340. Grams Ossclox, Cent., London.

Bright Steel Round Offcuts, packed in strong wood boxes, average weight of contents 4 cwt. Ideal for tool-room, model or small engineer. 100 boxes available, at 47s. 6d. each.—MACREADY'S METAL CO. LTD., 131/5, Pentonville Rd., N.1. TER. 7060.

CHARLES PORTASS & SON
Buttermere Works, Sheffield 8

STAMP PLEASE

3′ x 12½″ MOD. L £16·10·0

Please Send for List of Tool Cabinets 11s. 6d. to £2 7s. 6d. each. Bargains. Also 28 lb. assorted new bolts and nuts to ½″ diameter £1 10s., carr. paid. Also 24,000 hardened and ground drill bushes, 1s. each, 10s. for 12, £3 10s. for 100, about 50 sizes between No. 57 to ⅝ bores.—HUNTINGTON, 38A, Cemetary Road, Southport.

Britannia 6″ Stand Lathe, s.c., 4½″ centre chucks, drill chuck, good condition, no motor, seen after 6 o'clock, £35.—36, Cicada Road, Wandsworth, S.W.18.

Capstan Attachment, 6″ centre, £3 10s. Sketch, stamp.—BRADLEY, Forty-Three Blenhein Road, Birmingham, 13.

For Sale. Horizontal bench milling machine with countershaft and a.c. electric motor. No. 2 Morse taper. Bargain £20.—Box No. 7275, MODEL ENGINEER Offices.

Super Adept Lathe, 4-jaw, etc., as new, exchange for Wolf Cub electric saw kit, or what. Write—10, Green Lane, Thornton, Bradford, Yorks.

Collets for Lathes. No. 1 Morse, ⅛″, 5/32″, ¼″ and draw-bar, £1. Extra sizes 1/16″, 3/32″, 7/32″, ½″, 4s. each. No. 2, three collets and bar, 30s., sizes 1/16″, 3/32″, ⅛″, 5/32″, ¼″, 7/32″, ½″, ¼″, ⅝″, 5s. each. Guaranteed to half-thou. "Makes turning small parts a pleasure" (customer). State mandrel length. Seen by appointment. Supply is getting low. Postage 1s.—HOOD, 80, Ridgeview Road, London, N.20.

New Micrometers, 0-1″ and 0-25 mm., 35s. each Stainless 6″ vernier, £4. Send for list of other sizes.—ELLIOTT, Northfield, Kirkburton, Huddersfield.

Wanted. Top Slide for 3½″ Drummond lathe, also other parts for older type.—DUNMUR, 2, Latimer Close, Little Chalfont, Amersham, Bucks.

THE LOW TEMP METHOD OF ALUMINIUM BRAZING

This process is unrivalled for the fabrication of model racing cars etc., etc.

Makes perfect **UNBREAKABLE** joints in aluminium.

Complete outfit, including precision made blowpipe (self blowing) for use with household gas supply, flux, rods, etc., and full detailed instructions.

8/6 *post free*

A.G.S. EQUIPMENTS
23 Western Road, Cowlersley, Huddersfield.

Joiners Tools good kit. Sale lists.—LYDDELL, 4, Mile End Road, Colwick Notts.

"Star" 8 mm. Watchmaker's Lathe, with 10 collets, steel adaptor, wax chuck in cabinet. £26 10s., with compound slide rest, £20 extra. "Star" staking tool outfit, with 24 4.70 mm. punches, 4 stakes in cabinet £6 10s., or with 104 punches, 20 stakes, and micrometrical base, in cabinet, £16 15s. Stockists of "Boley & Leinen" Reform lathes, accessories and staking tool outfits. Alloy metal mainspring winder set, 8 arbors and key, p/w and w/w sizes, boxed, 32s. 6d. Clock polishing broaches, 46 to 74, with metal handles, ½ dozen, 7s. Clock cutting broaches, 46 to 74, with metal handles, ½ dozen, 6s. Carriage extra.—CRITERION STORES, 21, Clerkenwell Road, London, E.C.1.

MODELS AND FITTINGS

Scale Working Model exploration ship, by Bassett-Lowke (30″). Only used for film work, absolutely as new, complete in carrying case, £15, or near.—ROY, 9, Woodmansterne Road, Carshalton, Surrey.

LOCOMOTIVE ENGINES (English Make)

WANTED

Early Brass Locomotive Engines, wagons etc., in any condition or incomplete, as originally sold by any of the following well-known firms:—

Bateman, Lee, Lucas and Davies, Whitney, Steven's Model Dockyard, Macmillan, Carson, Wiles, H. J. Wood, etc.

Write giving description condition and price wanted to:—

WILLIAM E. APPLEBY
46, Silversea Drive, Westcliff on Sea, Essex.

"Juliet" Boiler, £9; "Tich" boiler large), £5 5s.; "Invicta" (5″ g.), threequarter completed, (boiler finished) offers? "Titfield" boiler, enquiries, s.a.e.—Box 7271, MODEL ENGINEER Offices.

Complete 7¼″ Gauge. Model railway with site for this season, Atlantic type loco, copper boiler, three railway type coaches, 200′ steel brass track, shed, £250. Quick sale.—Phone: Garston 2184.

Small Jet Engines. Build your own, simplest of all engines. Drawings and instructions only, 3s. 6d.—R. MARTIN, 12, Cromwell Road, Portsmouth.

Water Mill, 55s. Smock windmill, £3 10s. Both fine authentic working models.—RAWLINS, Keynavon Radfall Hill, Whitstable.

Wanted. Exhibition models, small scale locomotives, marine engines and motor cars.—Box No. 7277, MODEL ENGINEER Offices.

For Sale. 7¼″ gauge scale model 10-ton coal truck, sprung axles with ball bearings, £5.—Box No. 7276 MODEL ENGINEER Offices.

Wanted, 7 or 10 Gauge Locomotive, passenger carriages, also professional advice, information. South Devon.—Box No. 7279, MODEL ENGINEER Offices.

Superbly Fitted "O" Gauge Railway. Stud contact throughout, 700' track. Locomotives and stock ancient and modern. View by appointment.—Box No. 7281, MODEL ENGINEER Offices.

"Tich" Chassis and large boiler, tested, stainless steel Walschaerts gear all castings to complete. Offers?—Box No. 7283, MODEL ENGINEER Offices.

15" Gauge Model Locomotive required, four driving wheels, immediate inspection, good condition essential.—Box No. 7282, MODEL ENGINEER Offices.

3½" Gauge 4-6-0 locomotive chassis. Tender completed. Any reasonable offer. For full particulars.—Box No. 7287, MODEL ENGINEER Offices.

ANTI-RADAR STRIP DISPENSER UNITS
These comprise 2 1/20th h.p., 24 V shunt wound motors, with train of gears, both 25 and 50 to 1 reduction. The unit is mounted in an aluminium chassis and consits of over 100 gears, pinion shafts, etc, of the Meccano pattern, with variable speed switch and indicator light, bag of spares, and electrical diagram. These are all new and in original waterproof packages. They are something entirely new and have never been offered before. PRICE 30/- each. CARR. PAID.
H. MIDDLETON, 639, Abbeydale Road Sheffield, 7.

ELECTRICAL

House Service Meters. 200/240 V., (a.c. or d.c.). Credit or prepayment type.—UNIVERSAL ELECTRIC CO., 220, City Road, London, E.C.1.

A.C. Motors, Delco Capacitor start induction, 200/250 V, 50 cycles, 1 phase, 1,425 r.p.m., ½ h.p., £8 12s. 6d., 1/3 h.p. £4 17s. 6d. ¼ h.p., £6 10s. Perfect and guaranteed. Passenger carriage, 5s.—JOHNSON ENGINEERING COMPANY, 319, Kennington Road, S.E.11. Reliance 1412/5.

For Motors that Last! 100s. of a.c. and d.c. fractionals for every supply and dozens of others up to 50 h.p. Switchgear, converters. Purchases. Exchanges.—VERNON SMITH LTD., 364/366, King Street, W.6. Riv. 3964.

E.D.C. Rotary Convertor, 230 V, d.c., 230 V, a.c., 200 W, sound-proof cabinet, as new, £25.—WRIGHT, 19, Willcott Road, Acton, W.3. Acorn 6008.

Delco Motor 100/110 volt d.c. 1/6 h.p. 1,450 r.p.m. compound wound. Latest resilient mounted cradle type model, brand new, £8 o.n.o.—SMITH, "Ryber," West End Road, Wyberton, Boston, Lincs.

SITUATIONS

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 *inclusive or a woman aged* 18-59 *inclusive unless he or she or the employment, is excepted from the provisions of the Notification of Vacancies Order,* 1952.

Required. Experimental Engineers, part time for maintenance of equipment and small jobs, small laboratory, Central London.—Box No. 7278, MODEL ENGINEER Offices.

GENERAL

J.A.P. 98 c.c. Stationary Engine, £6 o.n.o. Villiers V20 engine, £8 o.n.o. 36 V, 36 Amp d.c. generator, as new, £8 o.n.o. Electric car, less batteries, £20. Callers only.—EVAN W. DAVIES, 13, Park Avenue, Cheadle, Hulme, nr. Stockport.

"Onan" 12 Volt Petrol Generator, 1 h.p. New spares. In excellent condition, with 3 batteries. £20 or near offer.—HAMILTON, 8, Great Heath, Hatfield, Herts.

Watch and Clock Lathes, cleaning machines, staking tools, etc. (Easy payment, terms arranged for purchases of £10 or over) Large illustrated catalogue, 1s. 6d. p.p. Price list, 1s. p.p. Stop watch and chronograph repairs and materials for the trade.—JOHN MORRIS (CLERKENWELL) LTD., 64, Clerkenwell Road, London, E.C.1.

Build Your Own Refrigerator, all components available at reasonable prices. Frigidaire, "Flowing Cold" units, £5, small single-cylinder units, Kelvinator, etc. £4; ¼ h.p. heavy duty motors, £3; Chrome cabinet fitting, new, £1 set. Money back guarantee. S.A.E. for lists and schematic diagram.—WHEELHOUSE, 1, The Grove, Isleworth, Middx. Hounslow 7558.

Compressor Equipment, miscellaneous items, etc. Catalogues, 1½d.—PRYCE, 157, Malden Road, Cheam.

Wanted. Vols. 100 to 103 inclusive, or copies giving all building instructions for L.B.S.C.'s "Tich." State price to—DR. GRIFFITHS, University Hospital, Edmonton, Alberta, Canada.

IMPETUS PRECISION PLANERS
Circular safety type cutter-head high quality tempered steel knives. Tables mounted on machined inclined ways. Ground table-surfaces. Fences adjustable to 45 deg. 4 in. MODEL Motorised, **£18/18/0.** 6 in. MODEL **£28/10/0.** **£9.10.0** Motorised, **£44/0/0.**
Send for Catalogues of other "Impetus" Products.
JOHN P. M. S. STEEL, Bingley, Yorks.
Phone: Bingley 3551 (4 lines)

"M.E." 1933-1949, almost complete, including five bound volumes. All good condition. £7 the lot.—N. RODNIGHT, 49, Ellington Road, Adeyfield, Hemel Hempstead.

Compressors for Sale. Twin pistons complete with air receiver, driving wheel, and motor cradle, 180 lb., 2½ cu. ft., price £3. Also 8 cu. ft. compressor only, £5. Motors, a.c. and d.c., all types, ¼ h.p., £3. Carriage forward.—WHEELHOUSE, 1, The Grove, Isleworth, Middx. Phone: Hounslow 7559.

Plywood, Hardboard, Blockboard, Hard Woods and Soft Woods. List 1½d. stamp. Veneered plywood, oak, mahogany and walnut, etc.—SPIERS, 330, Hackney Road, London, E.2. Phone: Shoreditch 8791-2-3.

"Spraying Handbook" 1950 ed. Car, caravan, industrial, domestic stoving, flock leather spraying, 3s. 6d., post free.—LEONARD BROOKS, 23, Harold Wood, Romford.

BARGAINS
ROTARY CONVERTERS 100 watt for operating mains equipment from battery or other D.C. source. Input 24 V, output 230 V, A.C. 50 cycles.
COWL GILL MOTORS with 4-stage reduction gear 625/1 magnetic brake and reversing switchgear 12 V, D.C.; marvellous job for experiments, 25/- only.
COMPASSES, ALTIMETERS, SWITCHES and a host of AIRCRAFT and ELECTRICAL SURPLUS.
Send us your enquiries.
STARAVIA
(Disposals Division)
Blackbushe Airport, Camberley, Surrey.

Rolleidoscope Wanted, 45 × 107, or similar; details to—E. H. Richardson, 330, Green Lane, N.4.

Portable Paint Sprayer, 230 V, a.c., spray gun, paint container, full working order; suitable home, farm or estate, £10.—SHUTER, Church Farm, Hughenden Valley, High Wycombe.

Silverlite Petrol Air Gas Generator, output 600 cubic feet per hour, weight/motor driven, suitable for laboratories of approx. 50 Bunsens or equipment, working order, inspection invited, £25 or offer.—GENERAL IRVINE, Wotton-under-Edge, 2267, Glos.

ROTARY COMPRESSORS
or Vacuum Pumps ex-R.A.F. Brand new 7 cu. ft. per min., 10 lb. per sq. in. at 1,200 r.p.m. **22/6,** post 2s.
BALL RACES.—No. EE2, ⅜ in. × ½ in., **3/-**
THRUST RACES.—13/16 in. × ⅝ in., **1/6**
KLAXON GEARED MOTORS, 230 V a.c./d.c. 100 r.p.m., torque 7 lb. in. No. EK3UBI-W3, 2 shafts on gearbox, complete with speed control box, etc., and instrument driven off the motor direct which can be recalibrated to read r.p.m. **£7 10s. 0d.**
Comprehensive List Now Ready 6d.
WILCO ELECTRONICS (Dept. M.E.)
204, Lower Addiscombe Rd., Croydon

TV Without Mains. "Chorehorse" petrol-electric generators as supplied to BBC. Complete, self-starting a.c. 220/250 V 300 watts, d.c., will charge batteries for lighting. £47 10s., delivery 10s. Other alternators at lower prices. Below.

D.C. Generators. Tiny Tim self-starting or Delco, complete 12/15 V, £14 10s., delivery 10s.—Below.

I.C. Engines, 1½ to 20 h.p., £12 10s. to £31 10s.—Below.

Storage Batteries. Heavy duty in hardwood cases, 12 V, 75 AH, £5 17s. 6d., delivery 9s. 6d.; 12 V, 22 AH, very powerful, £2 14s., delivery 5s. 6d.; 6 V, 150 AH, £5 17s. 6d., delivery 8s. 6d.; 6 V, 90 AH, in hard rubber cases, £3 7s. 6d., delivery, 7s. 6d.—Below.

D.C. Mains Motors, ⅛ to 10 h.p., approx. 75 per cent. below list.—Below.

Air Compressors. Hymatic 2-stage, 2½ cu. ft., 800 lb., £5 17s. 6d., delivery 3s. 6d. Reavell two-stage either 100/50 lb. p.s.i. or 400 lb., £27 10s., delivery 20s. Complete mobile plants from £69 10s. Tanks from £1 2s. 6d. and other air accessories.—TEDDINGTON ENGINEERING CO. LTD., Dept. "G," High Street, Teddington, Middx. KINgston 1193.

Wanted. "Model Engineer" Vols. 104 to 108.—PATRICK, Flat A, 160, Buckingham Palace Road, London, S.W.1.

Copper Tube Refrigeration quality, ¼", ⅜", ½", ⅝", 20' sealed coils, soiled, 25 per cent. under current price.—JACKSON, 17, Ealing Park Gardens, W.5.

50 x Astro Telescope Kits for simple assembly, efficient 2" dia. instrument at 40" focus, easily prepared in few minutes. Ready adaptable parts comprising: (1) selected 50 mm. dia. objective, mounted in special long aluminium cell, exterior stoves instrument black crystalline finish. (2) Eyepiece focusing holder. (3) Adjustable brass knurled eyepiece, magnification 50 diameters linear (equivalent 2,500 × area, shows intricate lunar detail, Saturn's rings, etc.). (4) Large self explanatory drawings with details of simple Altazimuth mountings, notes and test certificate. All parts machine turned. Precision lenses. Numerous testimonials, price 49s. 6d. Registered postage packing, 2s. 6d. Additional 80X eyepieces, 25s., post 9d. Schools and colleges supplied.—J. K. M. HOLMES, "Scientific Instrument Makers," (Dept. M.E.), "Vizcaya," Wolveleigh Terrace, Gosforth, Newcastle-on-Tyne, 3.

Ex-ADMIRALTY TELESCOPES. Highest quality single draw Telescopes by Ross of London and Ottway of Ealing. Average specification 16 x 42 mm. Length 16 in. Weight 2½ lb. Optically good, externally fair. Originally cost about £12. **65/-** post free.

3-in. ADMIRALTY COAST GUARD TELESCOPES. Suitable for Astronomical and Terrestrial use. Magnification 40X. Length 37 in. Optically good. Complete with rigid garden tripod. Estimated original cost about £50. Price **£10 15s. 0d.** to **£14 10s. 0d.** according to external condition. Part carriage 5/- extra.

Ex-AIR MINISTRY PRISM BINOCULARS. 6 x 30. Good used condition. Eyepiece focussing with leather case, **£8 5s. 0d.**

NEW 8 x 30 CENTRE FOCUSSING PRISM BINOCULARS. Coated . With leather case, **£12 10s. 0d.**

NEW 12 x 40 CENTRE FOCUSSING PRISM BINOCULARS. Coated. With leather case, **£15 10s. 0d.**

We guarantee satisfaction or full refund. Illustrated Brochure on request.

CHARLES FRANK

67-73, SALTMARKET, GLASGOW, C.1.

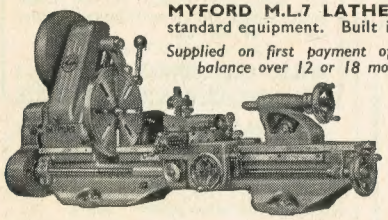
Phone: Bell 2106-7.

The ANNUAL SUBSCRIPTION to
THE MODEL ENGINEER
is £2-2-0 post free

It is published every Thursday and is obtainable from local newsagents or from the publishers direct (by subscription)

PERCIVAL MARSHALL & CO. LTD.
19-20, NOEL STREET, LONDON, W.1

MYFORD LATHES FOR PROMPT DELIVERY

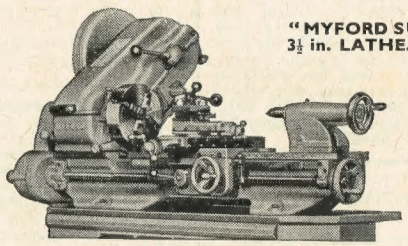


MYFORD M.L.7 LATHE. With standard equipment. Built in drive.

Supplied on first payment of **12/5/0** *balance over 12 or 18 months.*

CASH PRICE £48 5s. 0d.
Illustrated leaflet free on request

Telephone
BISHOPSGATE
2220



"MYFORD SUPER SEVEN" 3½ in. LATHE. 19 in. between centres. Fourteen spindle speeds. 25 to 2,150 r.p.m.

Supplied on first payment of **18/5/0** *balance over 12 or 18 months.*

CASH PRICE £73 5s. 0d.
Illustrated leaflet post free

ROSS & ALEXANDER (LONDON) LTD., 165 BISHOPSGATE, LONDON, E.C.1.

THE MODEL ENGINEER

CLASSIFIED ADVERTISEMENTS

- PRIVATE RATE **3d.** A WORD
- TRADE RATE **6d.** A WORD
- MINIMUM 12 WORDS
- BOX NUMBER 1/- EXTRA

To "THE MODEL ENGINEER" Classified Advertisement Dept., 19-20, Noel Street, London, W.1.

Please insert the advertisement below under

heading.....for.....insertions

Name .....

Address .....

Three insertions for the price of two. ★ Private advertisers only.

Please write in block letters. REMITTANCE VALUE ..... ENCLOSED

Printed in Great Britain for the Proprietors by ELECTRICAL PRESS LTD., Cordwallis Works, Maidenhead, Berks, and published by PERCIVAL MARSHALL & CO. LTD., 19-20, Noel Street, London, W.1.
Registered for transmission by Magazine Post to Canada including Newfoundland.

GET YOUR COPY NOW!

THE MODEL ENGINEER

LIST OF

PLANS & WORKING DRAWINGS

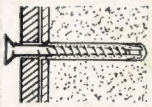
LOCOMOTIVES
MINIATURE BUILDINGS
MODEL CARS
PETROL ENGINES
TRACTION ENGINES
WORKSHOP EQUIPMENT
ETC. ETC.

PERCIVAL MARSHALL & CO. LTD.
19-20 NOEL STREET, LONDON, W.I.

Post Free from PERCIVAL MARSHALL & CO. LTD., 19-20, Noel Street, London, W.I.

RAWLPLUGS

— for speedy screw-fixing



For simple and speedy fixing of equipment, racks, motors, etc. to brick, stone or concrete—*use Rawlplugs!* There's a Rawlplug for every size of screw, and Rawlplug easy-to-use Tools for speedy hole boring. Popular Outfit 2/6d., Household Outfit 6/-, Handyman Outfit 9/6d., each complete with Rawlplugs, Screws, Hooks and 16-page booklet "Hints on Fixing".

RAWLPLUG
DURIUM
Registered Trade Mark

TIPPED DRILLS

— for fastest-ever masonry drilling

There's nothing to equal the astonishing speed of these drills in penetrating brick, stone, tiles, etc. The Durium new process carbide tip is harder than any metal or alloy, giving fifty times more life than ordinary drills. In sizes from 5/32" to 1" diameter—can be used in hand or electric drills.

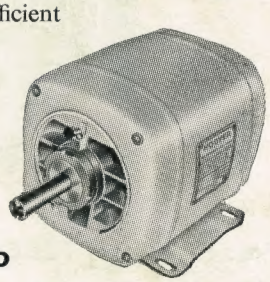
TRADE ENQUIRIES INVITED

B472

THE RAWLPLUG COMPANY LIMITED, LONDON, S.W.7

"My workshop is equipped with RELIABLE POWER!"

A MODERN home workshop of today should be fitted with a Hoover F.H.P. motor — the motor for reliable power. The Hoover 'fractional' has everything the hobbyist needs — dependability, durability and adaptability. It is really sound investment. Precision made and modern in design, the Hoover F.H.P. motor is an essential piece of equipment for the hobbyist who wants to have an up-to-date and efficient workshop.



For full details write to :—

HOOVER LIMITED

INDUSTRIAL PRODUCTS DEPARTMENT

CAMBUSLANG · LANARKSHIRE · SCOTLAND